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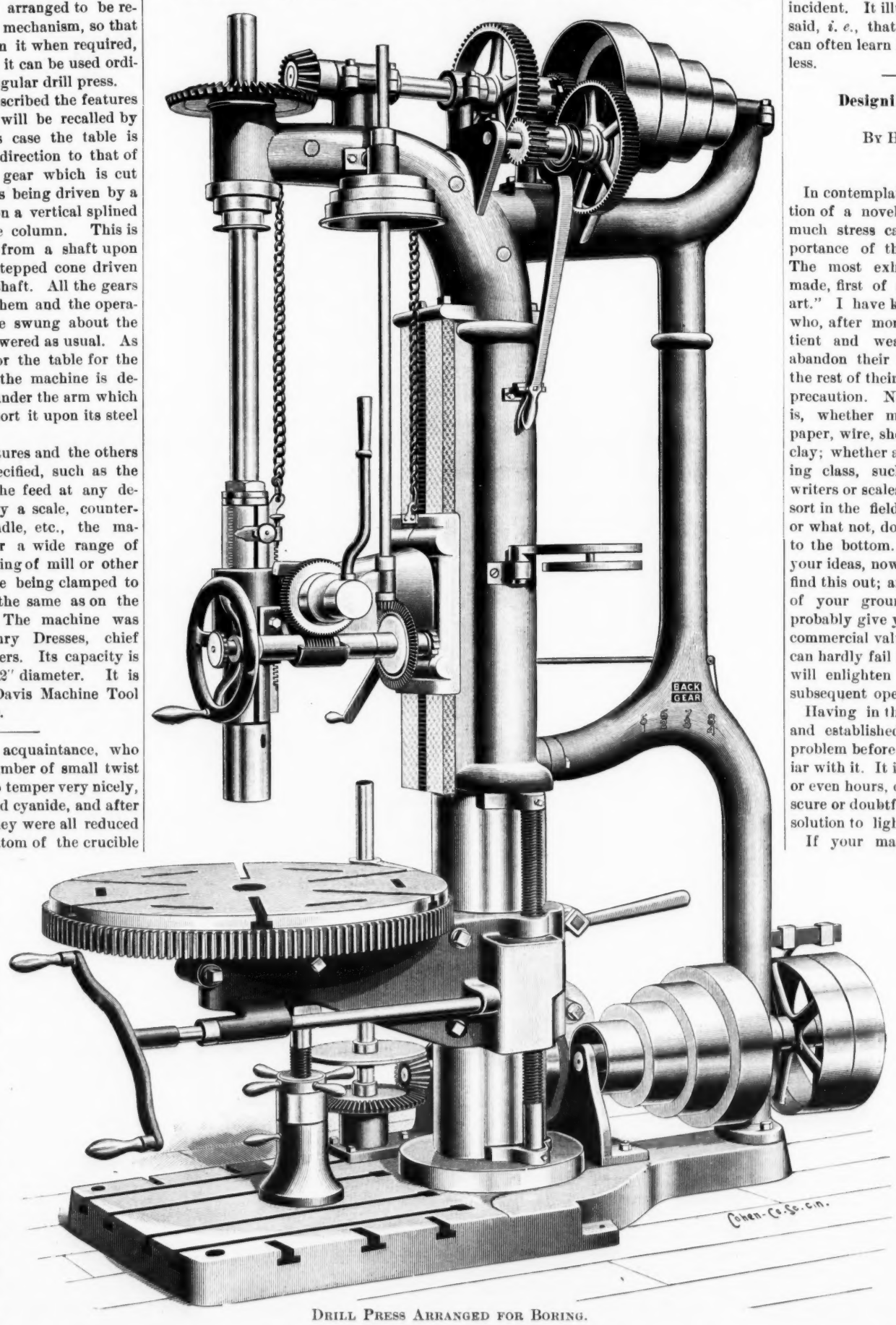
Drill Press Arranged for Boring.

The illustration on this page is of a drill press having the table arranged to be revolved by independent mechanism, so that boring may be done upon it when required, while at the same time it can be used ordinarily the same as the regular drill press.

We have heretofore described the features of the press, and they will be recalled by the engraving. In this case the table is driven in the opposite direction to that of the spindle by a spur gear which is cut upon the periphery, this being driven by a pinion which is placed on a vertical splined shaft at the side of the column. This is driven by bevel gears from a shaft upon which there is a four-stepped cone driven from a separate countershaft. All the gears are covered to protect them and the operator, and the table can be swung about the column and raised or lowered as usual. As an additional support for the table for the heavy work for which the machine is designed, a jack is placed under the arm which can be adjusted to support it upon its steel screw.

With these special features and the others which we have not specified, such as the automatic release for the feed at any desired point indicated by a scale, counterbalanced head and spindle, etc., the machine is very useful for a wide range of work, including the boring of mill or other gears, pulleys, etc., these being clamped to the table and trued up the same as on the face-plate of a lathe. The machine was designed by Mr. Henry Dresses, chief draftsman for the builders. Its capacity is to bore work up to 42″ diameter. It is made by the Lodge & Davis Machine Tool Company, Cincinnati, O.



DRILL PRESS ARRANGED FOR BORING.

A mechanic of our acquaintance, who some years ago had a number of small twist drills which he wished to temper very nicely, immersed them in heated cyanide, and after quenching found that they were all reduced in diameter. At the bottom of the crucible containing the cyanide he found a small lump of what he took to be steel, which he thought had been removed from the drills, thereby reducing them. It would be of interest to know if any others of our readers have ever had a similar experience with cyanide.

An American was some years ago introducing in England an improved fog horn of his own invention, after having failed to interest any one in this country. He came into contact with the famous scientist Farraday, and was asked by him what his theory was as to the reason that any loud sound like that made by a fog horn could be much more distinctly heard at sea if the instrument producing it were close to the surf than if it were raised considerably above it, where it would seem to be much less liable to be drowned out by the noise of the surf. The American expressed surprise that such a man as Farraday should ask such a question of him—a man whose scientific attainments would not compare with those of his distinguished questioner, and was informed by Farraday, that he had made it a practice all his life to seek and obtain information and opinions upon matters of science from practical men whose work was directly connected with the branch of science under investigation by him, and that he had in that way gained much information that had been of the greatest value to him. There is a lesson in this incident. It illustrates what we have often said, *i. e.*, that those who know the most can often learn from those who know much less.

Designing New Machinery.

By HENRY B. MORRIS.

II.

In contemplating the design and construction of a novel and peculiar machine, too much stress cannot be laid upon the importance of thorough preliminary study. The most exhaustive inquiry should be made, first of all, as to the "state of the art." I have known many ingenious men, who, after months or years of the most patient and wearing toil, were forced to abandon their schemes, and to regret, for the rest of their lives, their neglect of this precaution. No matter what your project is, whether machinery for manipulating paper, wire, sheet metal, wood, leather or clay; whether an apparatus of the registering class, such as cash counters, typewriters or scales, or an improvement of some sort in the field of hydraulics, pneumatics, or what not, do not fail to probe the subject to the bottom. If others have anticipated your ideas, now is the best of all times to find this out; and, if not, then you are sure of your ground. Your researches will probably give you very clear ideas as to the commercial value of your new machine, and can hardly fail to present suggestions which will enlighten and assist you in all your subsequent operations.

Having in this way cleared the ground, and established your premises, study the problem before you until you become familiar with it. It is wonderful how a few days, or even hours, of calm reflection over an obscure or doubtful point will often bring the solution to light and straighten matters out.

If your machine belongs to the class which operate in any way upon some sort of material, remember, from first to last, that your chief difficulty is likely, as a rule, to consist in the nature of that material. Proper movements of the various working parts of your machine can be readily obtained almost without limit. Here the questions involved are mainly mathematical ones which can usually be fully disposed of upon the drawing board. But the material is the one thing which you did not choose, and cannot change. It is, so to speak, the enemy to be overcome. In its character and possible behavior difficulties and doubts may reside which no amount of cogitation can settle. Very often, too, there are variations in its quality that will be troublesome in the extreme. Nothing but preliminary experiment can help you here, and this

should be fully tried until you are satisfied that you know all the tricks that your enemy can play.

I once knew a most accomplished mechanic whose head was full of ingenuity and mathematics. He spent a year and many hundreds of dollars in building an intricate but beautiful machine for punching letters in a metallic plate, from which a stereotype was afterward to be made for printing—a substitute for type-setting. He was too busy over his drawings to think much about the real problem, and found, when his machine was complete, that though it punched the first letter in capital form, the punching of an adjoining one so displaced the metal as to distort the first out of all recognizable shape. Here, then, was a difficulty which was, in the nature of things, irremediable and final. When, almost heart-broken, he showed me his machine, difficulty and all, I couldn't help secretly wishing that, before he had drawn a line, or made a pattern, he had procured a sample of the metal, some punches, and a hammer, and, at a cost of two or three dollars, discovered his ambushed foe, and avoided the tragedy which followed.

Sometimes, it is true, there are problems which can only be fully settled by long use of the finished machine, such, for instance, as the endurance of tools which must encounter some hard or refractory substance. But even in these cases, unless the material be a new and unknown one, a pretty clear idea can generally be obtained by closely observing the results of such other manipulation of the stuff as has formerly been practised.

If you are an employe of some one else, a draftsman or superintendent, for example, in a manufacturing concern, then, as you value success and your own good name, don't let them push you headlong into failure by hurrying you. The more ignorant your employers are of such matters, the more likely they will be to attempt this; at the same time, there are lots of men who ought to, and do know better, whose anxious haste will lead them to crowd you so that you can't stop to think. Perhaps the new machine is to supply a "long-felt want" in the works, which they have known for years; but now they have suddenly resolved to have you design and build it, involving, as it does, a dozen novel and altogether untried problems, and they want it "within the next ninety days—in time for this season's business." You can't run a race against time in such work as this, and the sooner you tell them so the better. To attempt it would be quite as foolish as if you were to tell them what you think it will cost, when you don't know yourself. There is one statement which you will nearly always be safe in making, for the event will usually justify it. New and experimental machinery commonly requires more time and money for its construction than any one expected. And if the operation is pursued to a successful end, you generally find that you have been led into a much bigger job than you had looked for.

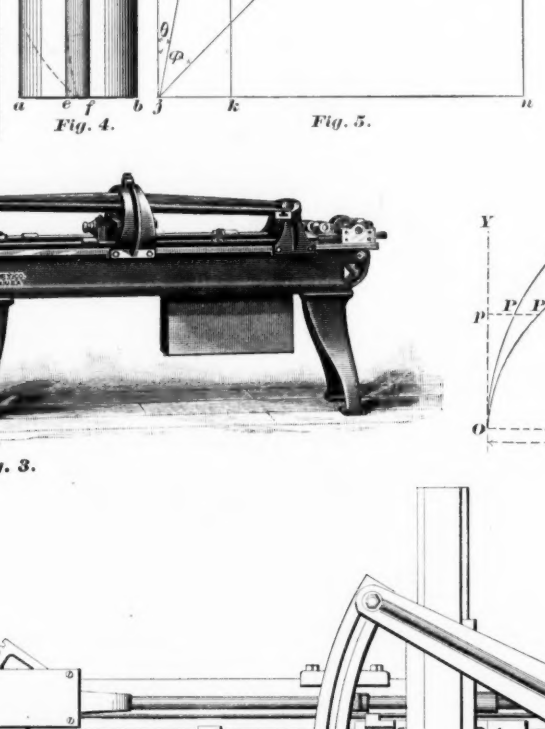


Fig. 4. Fig. 5.

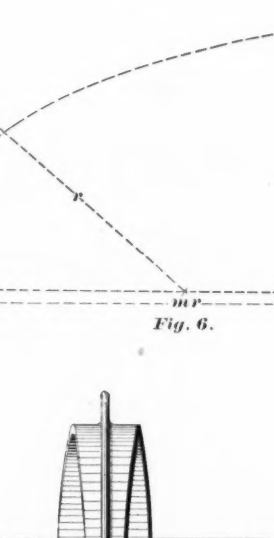


Fig. 8.

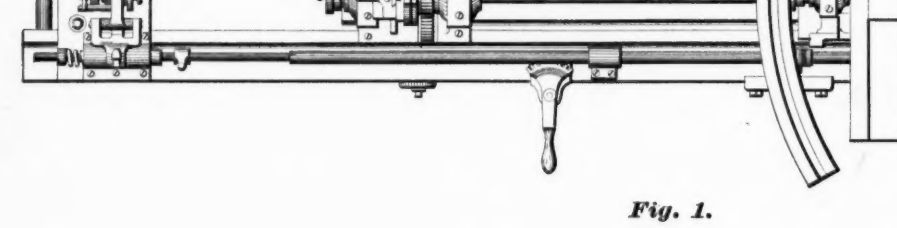


Fig. 3.

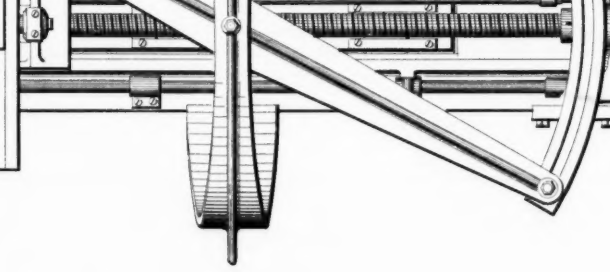


Fig. 6.

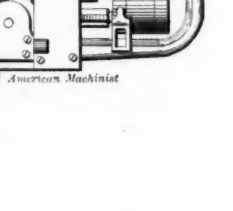


Fig. 7.

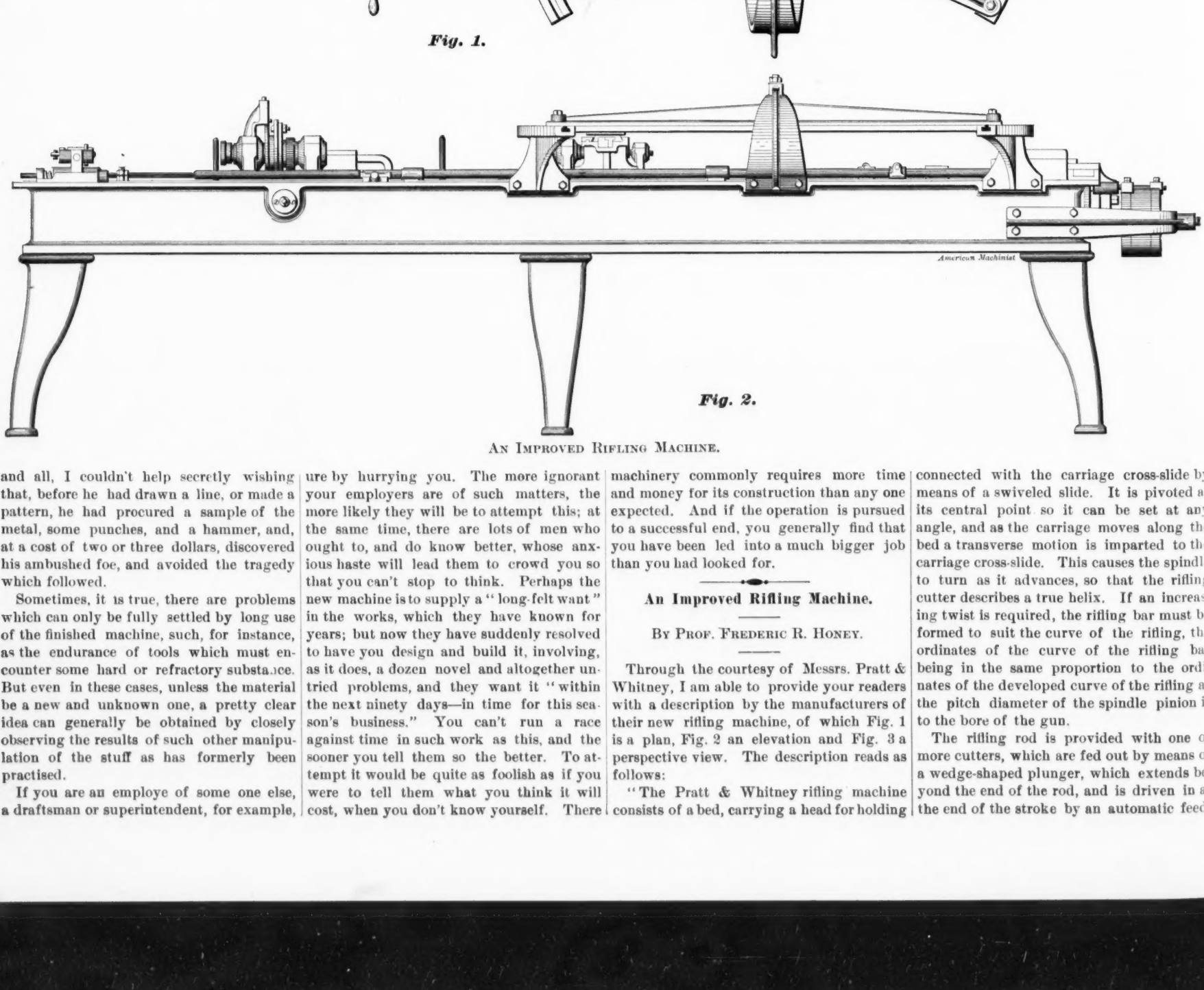


Fig. 1.

Fig. 2.

AN IMPROVED RIFLING MACHINE.

An Improved Rifling Machine.

BY PROF. FREDERIC R. HONEY.

Through the courtesy of Messrs. Pratt & Whitney, I am able to provide your readers with a description by the manufacturers of their new rifling machine, of which Fig. 1 is a plan, Fig. 2 an elevation and Fig. 3 a perspective view. The description reads as follows:

"The Pratt & Whitney rifling machine consists of a bed, carrying a head for holding and indexing the barrel, and a carriage having a spindle for holding the rifling rod, and all the appliances necessary to control its motion and feed the cutters automatically.

The head has a spindle which holds the barrel by means of a convenient chuck, and is provided with an indexing arrangement by which it is automatically turned at the end of each stroke of the rifling rod through the proper angle to give the required number of grooves.

The carriage has a spindle for holding the rifling rod, on which is a pinion meshing with a rack on the carriage cross-slide. The carriage is given a reciprocating motion by means of an ordinary open and crossed belt-reversing mechanism, which is operated by dogs on the carriage at the ends of its stroke. The rifling bar controls the twist of the rifling, and is placed above the carriage, and connected with the carriage cross-slide by means of a swiveled slide. It is pivoted at its central point so it can be set at any angle, and as the carriage moves along the bed a transverse motion is imparted to the carriage cross-slide. This causes the spindle to turn as it advances, so that the rifling cutter describes a true helix. If an increasing twist is required, the rifling bar must be formed to suit the curve of the rifling, the ordinates of the curve of the rifling bar being in the same proportion to the ordinates of the developed curve of the rifling as the pitch diameter of the spindle pinion is to the bore of the gun.

The rifling rod is provided with one or more cutters, which are fed out by means of a wedge-shaped plunger, which extends beyond the end of the rod, and is driven in at the end of the stroke by an automatic feed-

ing device. This is arranged so that the feed is always alike, whatever the variation in the travel of the carriage, and stops feeding when the cut has reached the proper depth. The rifling bar being set at the proper angle, and all the dogs and stop nuts being adjusted, the barrel is placed in the head, and the machine started by a lever placed at a point on the bed where the operator can observe all the motions of the machine. After starting, the carriage continues its reciprocating motion, the head indexes the barrel at the end of each stroke, and the cutters are fed until the grooves have reached the proper depth; when the feed stops the machine is stopped by the operator, and a fresh barrel is put in place.

The No. 3 rifling machine shown in the cut is designed to take gun barrels of any size up to forty-five caliber and thirty-six inches long. The regular machine is arranged for four, five and six grooves of uniform twist, from straight to one turn in nine inches, either right or left hand, but can be built for any number of grooves, and for an increasing twist of any desired curve. The cutting speed for ordinary steel is twenty-five feet per minute, and is uniform throughout the stroke. The length of machine over all is thirteen feet, and weight, with countershaft, 2,700 pounds.

An oil pump floods the cutter with oil at each end of the stroke. All the motions of the machine can be controlled by the operator without changing his position. It is entirely automatic after being started. The rifling rod is driven back and forth, the barrel indexed, the cutter fed, and the machine stopped when the work is completed without attention.

Speed of countershaft, 234 revolutions per minute; speed of the machine-driving pulley, 360 revolutions per minute.

The Pratt & Whitney Co. build machines of this pattern of any size or style desired. The machine is covered by patents issued to C. W. Sponsel, and assigned to The Pratt & Whitney Co., February 24, 1891."

THE ADJUSTMENT OF THE RIFLING BAR.

It is interesting to study the principle which governs the adjustment of the rifling bar. In order to bring it clearly before the reader, we will suppose for the moment that the pitch diameter of the pinion is *equal* to that of the bore of the gun. In this case the rifling bar should form with the axis of the machine an angle of 6°; *i. e.*, the same angle as that formed by the helix. If, however, the pitch diameter of the pinion is *not* equal to that of the bore, the rifling bar must be set to give the required pitch to the curve. Fig. 4 represents two helices of the same pitch, the diameter of the cylinder upon which one is described being five times the diameter of the other. Now it will be seen that if the diameter of the cylinder $a\ b\ c\ d$ is equal to the pitch diameter of the pinion, while the diameter of the cylinder $e\ f\ g\ h$ is equal to that of the bore, while a point on the circumference of the pitch circle of the pinion describes the larger helix, the point of the tool describes the smaller helix. The rectangle $j\ k\ l\ m$, Fig 5, is the envelope of the cylinder $e\ f\ g\ h$; and $j\ n\ p\ m$ is the envelope of the cylinder $a\ b\ c\ d$. The straight lines $j\ l$ and $j\ p$ are the helices on the developed surfaces of the cylinders; Θ and φ (here very much exaggerated) are respectively the angles with the axis formed by the helices described by the point of the tool, and by any point on the circumference of the pitch circle of the pinion. In the case under consideration, $m\ p$ is equal to $m\ l \times 5$; therefore the tangent of φ is five times the value of the tangent of Θ. The tangent of $6° = 0.1051$; $0.1051 \times 5 = 0.5255$; 0.5255 is the tangent of 27° 43½′ nearly, which is the angle the bar should form with the axis.

To determine the value of φ when the pitch diameter of the pinion bears to the diameter of the bore any given ratio.

Let D = pitch diameter.
d = diameter of bore.
p = pitch of helix.

$$\therefore \text{ tangent } \varphi = \frac{\pi D}{p}$$

$$\text{tangent } \Theta = \frac{\pi d}{p}$$

$$\therefore \frac{\tan.\ \varphi}{\tan.\ \Theta} = \frac{D}{d} \therefore \tan.\ \varphi = \frac{D}{d} \tan.\ \Theta$$

from which, Θ being known, φ is easily determined.

THE CURVED RIFLING BAR.

When it is required to form an "increasing twist," *e. g.*, one of the curves described in the article "Rifle Curves."*

When the curve on the barrel is an arc of a circle, the curve of the rifling bar will be an arc of an ellipse. For it will be seen by referring to Fig. 5 that for any point P on the surface of the barrel we have a corresponding point P' on the rifling bar. The distance $o\ P$ is equal to $o\ P$ multiplied by some constant (in this particular case 5). Similarly, Fig. 6, the distance $p\ P'$ for *any* point P is equal to $p\ P$ multiplied by some constant. Therefore, referring the circle to the co-ordinate axes X and Y origin at o, calling the radius r, its equation is $y^2 = x\,(2\,r - x)$ [1]

Now if the pitch diameter of the pinion is equal to m times the diameter of the bore of the gun, we see that for any point P on the surface of the barrel we must have a corresponding point P' on the curve of the rifling bar, *i. e.*, $p\ P'$ must be equal to $p\ P \times m$; calling the abscissas of the curve of the bar x, $x = \frac{x'}{m}$. Substituting this value of x in equation [1] we have:

$$y^2 = \frac{x'}{m}\left(2\,r - \frac{x'}{m}\right) = \frac{2\,r\,x'}{m} - \frac{x'^2}{m^2} \quad [2]$$

Making $x' = m\,r + x''$, equation [2] becomes:

$$y^2 = \frac{2\,r\,(m\,r + x'')}{m} - \frac{(m\,r + x'')^2}{m^2}$$

which, after reduction and dropping accents, gives:

$$m^2 y^2 + x^2 = r^2 m^2 \quad [3].$$

In order to get this equation into the ordinary form, *i. e.*, when the products of the coefficients of the terms of the first member shall be equal to the second member, multiply [3] by r^2,

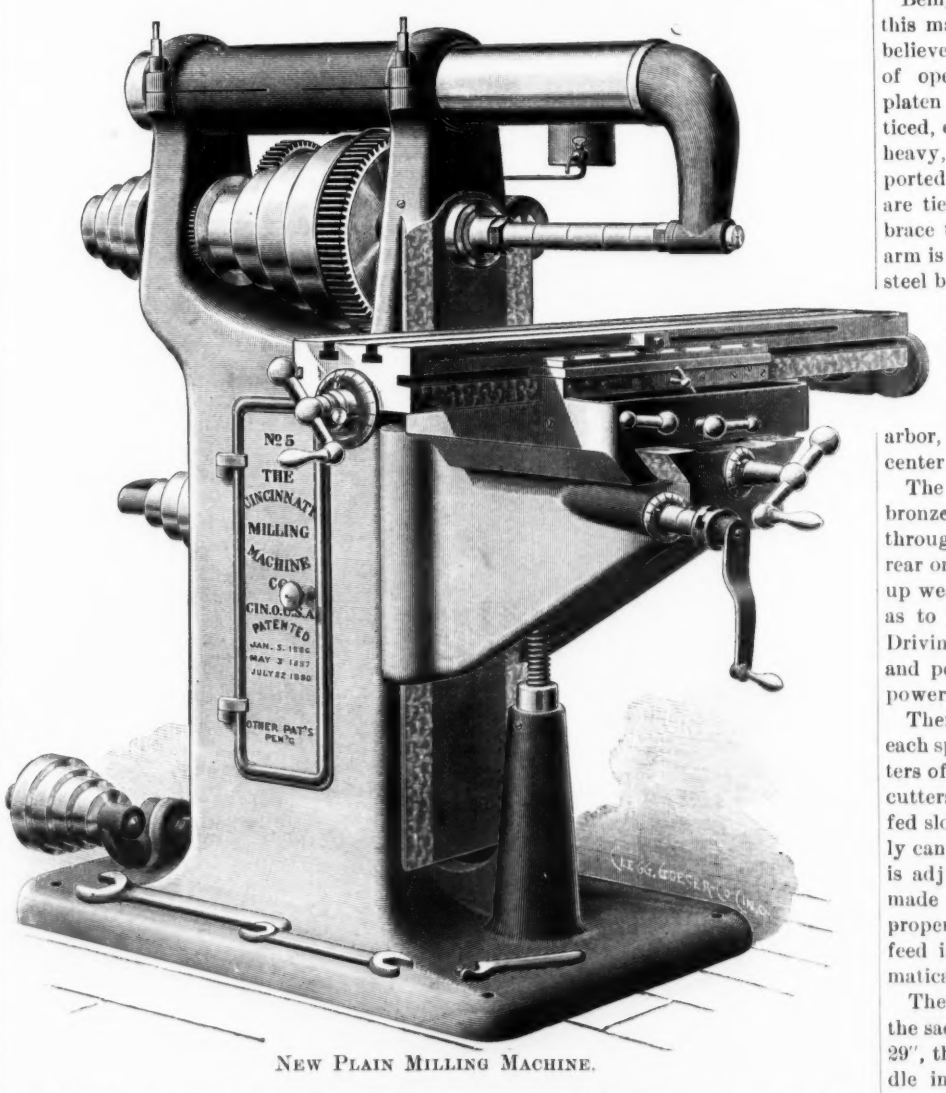
THIRTEEN-INCH DRILL PRESS.

and we have $m^2 r^2 y^2 + r^2 x^2 = m^2 r^4$,

which is the equation of an ellipse referred to its center o' as the origin. The semi-major axis $= m\ r$. The semi minor axis $= r$.

From the foregoing it will be evident that if the curve on the surface of the barrel is a common parabola, Fig. 7, whose equation is $y^2 = a\ x$ [4], and the pitch diameter of the pinion is equal to m times the diameter of the bore, x being equal to $\frac{x'}{m}$ equation [4] becomes $y^2 = \frac{a}{m}\ x$, which is a common parabola with a new constant. Similarly, if the curve on the barrel is a semi-cubical parabola, Fig. 8, whose equation is $y^3 = a\ x$, the equation of the curve of the bar becomes $y^3 = \frac{a}{m}\ x$, or another semi cubical parabola.

Trinity College, February, 1892.



NEW PLAIN MILLING MACHINE.

* In the article referred to, the mode of constructing the curves only is explained. If the reader is not familiar with the subject of rifling, he may read in the article "Gun Making," Ency. Brit. ix. ed., page 294 *seq.* On page 295 is a table showing a comparison of the pressure on the studs with uniform twist, common parabola and semi-cubical parabola.

Thirteen-inch Drill Press.

We present with this an engraving of a light drill press, its capacity being from the smallest sizes up to ⅝-inch holes. It will be noticed that gearing is dispensed with in the driving mechanism, and long belts are used in such a manner as to secure steady and quiet running. The spindle, which is of crucible steel, is counterbalanced by a spring, is reamed for the No. 1 Moss taper, and driven by a pulley so mounted as to relieve the spindle from belt pull. The table is moved upon the column by the screw seen at the side, and can be swung upon the column in either direction. A bell and V center are furnished for drilling centers. The distance from the face of the column to the center of spindle is 6⅝ inches. The spindle will move 4½ inches. The greatest distance from the spindle to the table is 36 inches. The table is 11¾ inches in diameter; the cone pulleys have three steps for two-inch belt. The quill-rack and pinion, all shafts and the screw are of steel. The column has a center line drawn upon it, by which the table can be set central with the spindle. A square or round base is furnished, as desired. The weight of the machine is 350 pounds, and it is manufactured by the Worcester Chuck Co., Worcester, Mass.

Plain Milling Machine.

The engraving on this page is of a new plain milling machine which has recently been brought out by the Cincinnati Milling Machine Co., of Cincinnati, O.

Being designed especially for heavy work, this machine has been made as heavy as is believed to be consistent with convenience of operation, the overhanging arm, the platen and the knee being, as will be noticed, especially heavy. The column also is heavy, and the uprights, in which are supported the boxes and the overhanging arm, are tied together at the top by a cylindrical brace through which the arm passes. The arm is 5″ diameter and carries a hardened steel bushing in which the outer end of the arbor is supported by a bearing formed upon it, this bearing being parallel and of ample size for the work to be done by it, and since it also allows for expansion of the arbor, works much better than the ordinary center support.

The spindle is 4½″ diameter, runs in bronze boxes, and has a ¾″ hole entirely through it. Front bearing is taper, and the rear one straight, with provision for taking up wear in both of them in such a manner as to preserve alignment so far as possible. Driving cone is 14″ diameter for a 3½″ belt, and powerful back gears give ample driving power.

There are twelve changes of speed for each speed of the spindle, thus enabling cutters of any size to be properly used, small cutters used with high spindle speed being fed slowly, while larger ones running slowly can be fed rapidly. The lower feed cone is adjustable, so that the feed belts can be made endless and can be adjusted to the proper tension by means of this pulley. The feed is in either direction and trips automatically either way.

The platen is 50″ long, has a bearing in the saddle 20″ long, and feeds automatically 29″, thus giving it a full bearing in the saddle in any position. It is unusually deep (3⅞″), and is gibbed square with provision for taking up all wear. It is fed by a screw and provided with a large dial which indicates movements in thousandths of an inch. There is a quick return motion on it of three to one.

The saddle and knee are also quite heavy, the latter being closed up below by a web which makes it of the box form, the idea of

this being to secure the greatest possible rigidity. It has a bearing on the column 17″ long. It is raised and lowered by a crank which is on a shaft entering at an angle so that it does not interfere with the cross-feed crank, and both of the cranks remain in their places ready for use at all times.

The platen is 9½″ wide, has a movement of 8″ in line with the spindle, and a vertical movement of 20½″. Cutters 15½″ diameter can be used under the arm. The machine weighs complete 3,000 pounds.

The Buffalo "B" Volume Blowers.

The fan illustrated herewith is of the type known as "Buffalo 'B' Volume Blower," especially designed and adapted for blowing forge fires, for forced draught under boilers, and similar uses requiring quite a volume of air at a moderate pressure. Though somewhat similar in appearance to the cupola blowers, the fans are so constructed that a larger volume of air is furnished in a given diameter, but not at so sharp a pressure of blast at the same speed. In the southern States, in Cuba, and in South America, especially on sugar plantations where bagasse is the principal fuel, scarcely a battery of boilers will be found without forced draught, and these types of blowers, especially in the larger sizes, are widely used for the purpose. When properly applied they insure perfect combustion when using fuel of this nature. They are usually run from four to seven ounce pressure, according to the conditions and fuel burned.

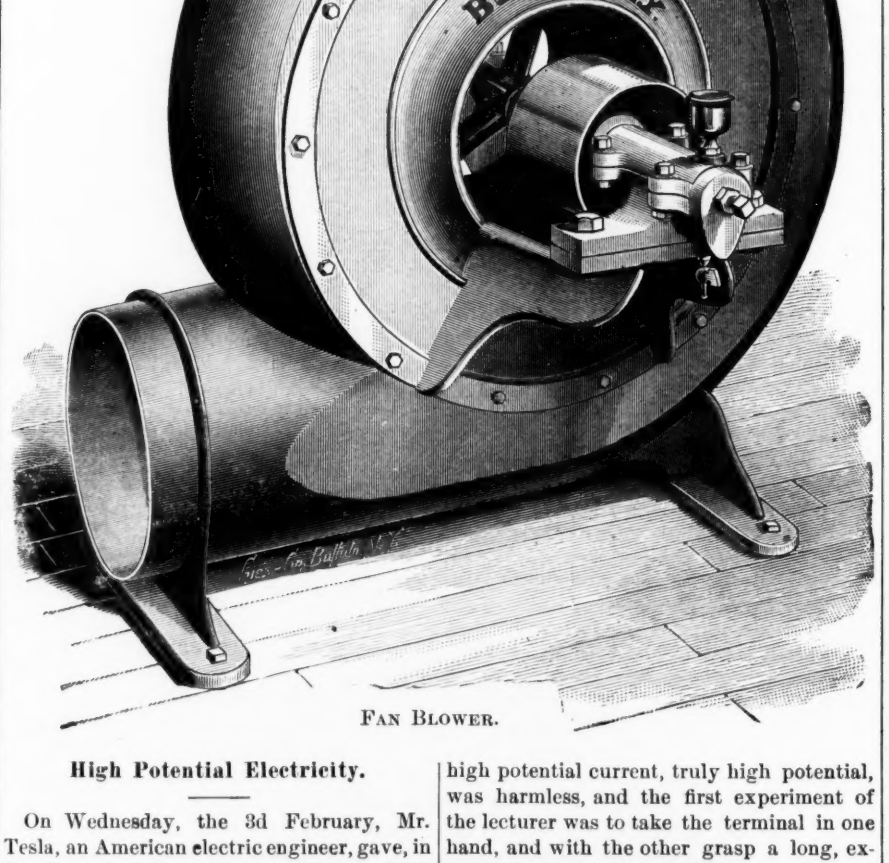
Where fans with direct connected engines are required, steel plate blowers with double direct connected vertical inclosed engines are very convenient, if not too great a pressure of blast is needed. Work requiring heavier blast than it is practicable to obtain from the steel plate fans with direct connected engines, owing to the speed required, and which would be injurious to the life of a direct connected engine, can be accomplished with the style of blower illustrated herewith; and if it is desired to have independent power they are placed upon bed-plates and an engine is furnished on the same foundation connected direct to the countershaft, and by proper proportionment of pulleys the blower can be run to obtain a maximum pressure while the engine is making moderate speed. By this arrangement the speed of the blower can be instantly changed.

The Buffalo Forge Company, Buffalo, N. Y., makers of the blowers known as the "B" type, have recently materially improved their construction, and the illustration shows their latest design. The manufacturers state that the journals are long and heavy, that the different parts of the fan are so well proportioned and fitted to each other, that, at the highest speed, there is no vibration. These blowers are made with a solid shell or casing, and have a smaller number of parts than any other form of construction, which, of course, is a valuable point in all high-speed machinery.

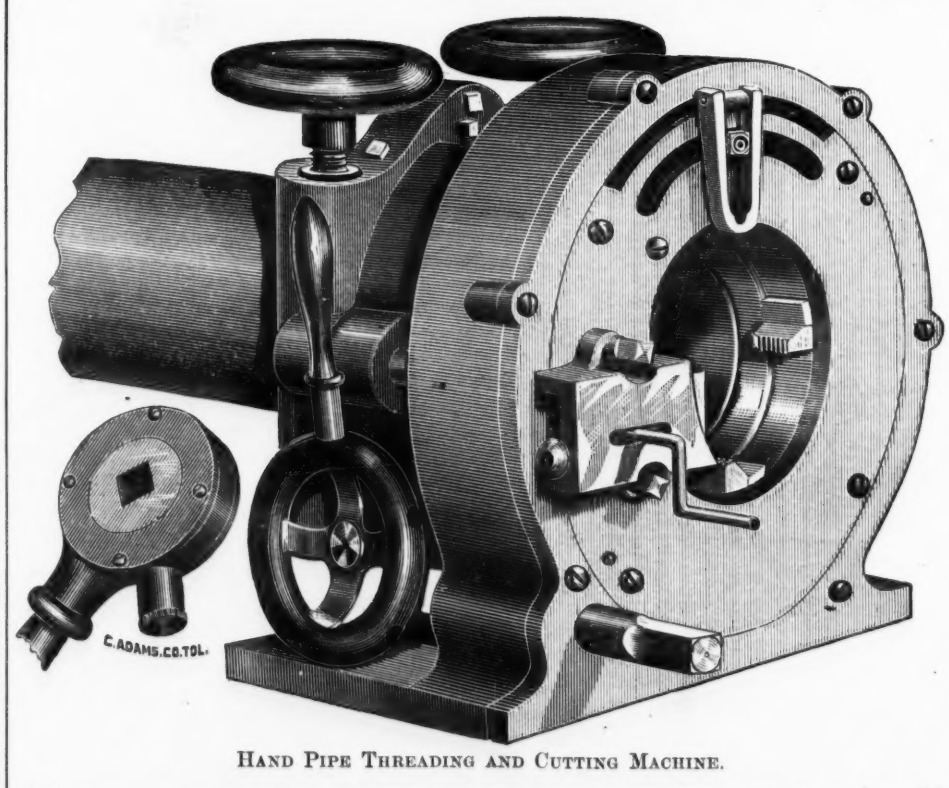
Hand Pipe Threading and Cutting Machine.

The accompanying engraving represents a portable, self contained hand pipe cutting and threading machine, which is made in various sizes by the Wells Machine Works, of Fostoria, O. The machine is so arranged that one person can readily cut off and thread pipe of any size. Five chasers are used, which are adjustable, one set being used for several sizes of pipe. They are released while cutting, and can readily be removed and replaced, sharpened by grinding, or duplicated if one or more is injured or lost.

The cutting-off tool is so mounted as to be always in position ready for use, and there is a gauge which prevents its being broken by over-feeding on a pipe which is out of round. The pipe is held in a self-centering steel-faced vise, with collet which centers it with the chasers, and the pipe is fed forward by rack and pinion, motion being imparted by the hand wheel and lever seen at the side of the machine, thus giving a rapid and easy feed of the pipe to the die, and its quick withdrawal and release after being threaded. The machines are easily transported, and a special effort has been made to make them as simple in construction as possible.



FAN BLOWER.



HAND PIPE THREADING AND CUTTING MACHINE.

High Potential Electricity.

On Wednesday, the 3d February, Mr. Tesla, an American electric engineer, gave, in London, a lecture on his researches in high tension alternating currents of enormous frequency.

For some years, Mr. Tesla, who is, we believe, an Hungarian by birth, has made a study of high potential currents, and the results he has obtained are marvelous and significant.

There was a large audience, including many of the best known men in the scientific world.

Mr. Tesla began by acknowledging his indebtedness to Professor Crookes, whose researches had been so largely the means of directing the studies and researches of the lecturer himself.

The electricity he dealt with possessed a frequency of alternation of many thousand per second, being generated by a gas-engine driven dynamo of rapid alternation, which passed current through an induction coil, and finally through a condenser. This high potential current, truly high potential, was harmless, and the first experiment of the lecturer was to take the terminal in one hand, and with the other grasp a long, exhausted glass tube, which at once became brilliantly phosphorescent. Next he approached the free hand to an exhausted bulb, and this, too, glowed with a bright phosphorescent light.

Exhausted globes hung to a single lead glowed with light, but what was more marvelous still, a pair of cotton-covered wires stretched across the room, and into which the high potential was led, became luminous, not with incandescence, but with phosphorescent light. This was the most striking manifestation of the powers and qualities of such currents made during the evening.

To show the effect in producing a field of energy, there was a sheet of metal some eight feet long by nine inches in width stretched over the table at a height of several feet.

When charged by connection with the terminal an exhausted tube, moved in the field, glowed brightly, even when four or five feet distant from the plate.

The lecturer forecast the time when the present incandescent lamp would be obsolete, for light would be produced by other and simpler means, and he placed a bulb containing zinc sulphate upon the wire, and the result was a light of remarkable beauty and brilliancy.

The lecturer labored somewhat from the lack of power to express himself in English as clearly as he could have wished, and the time was too short for all the experiments he wished to show, but he described one where, in a bulb placed in current, a conical brush of light would appear between the terminal in the bulb and the glass envelope, which brush of light could be rotated by the influence of a magnet.

He showed also how a Crookes radiometer was caused to rotate, but curiously in an opposite direction from its rotation, under the influence of light.

Another remarkable experiment was the suspension of three exhausted bulbs of two, three, and four inches diameter to one single terminal, when he showed how the light given off by a small sphere of carbon in each bulb varied according to the position of the bulbs, the small one being as powerful as the largest when placed in the middle of the row.

It appears that such high potential currents do not need two wires in circuit. The discharge between two poles was actually improved by interposing a sheet of vulcanite, otherwise capable of cutting off the most powerful current. The apparatus, the audience were informed by Mr. Tesla, consists of ordinary apparatus of every-day description, the current being first generated by a dynamo which has a stationary armature. This armature carries 380 coils.

The revolving portion is a disk of thin iron, also carrying 380 magnets coupled in series, and revolved close to the armature coils with the minimum possible clearance. This dynamo gave a distinctly musical tone as it revolved, and emitted an alternating current of some 13,000 frequency, which served as the raw material for the large induction coil and condensers to operate on afterwards to secure the full potential required, which may be counted in hundreds of thousands of volts.

It was truly remarkable to see such high potential currents taken through the lecturer's body as a mere unfelt nothing, and yet to observe how, after being thus transmitted, they could cause exhausted globes and tubes to glow with light. Mr. Nicola Tesla did not spend much time in explanation of the wonders he showed, and even well-informed electricians seemed as babes in beholding the wonders set before them.

This new development of electrical service opens up a large field of research and experiment, and will doubtless give rise to much speculative thought in the near future.

Mr. Ferranti, with his 10,000 volts at Deptford, becomes a mere low-tension man, and seemed to be hugely interested as he listened to the new prophet, who has surpassed him in his own specialty. Mr. Swan, of Newcastle, would hear with perhaps a sigh of regret, tempered doubtless by recollection of the gold he has reaped from his monopoly, that in the future we may obtain our light with very much more refined appliances than the present incandescent lamps. Mr. Tesla has, we are informed, been an American for some ten years.

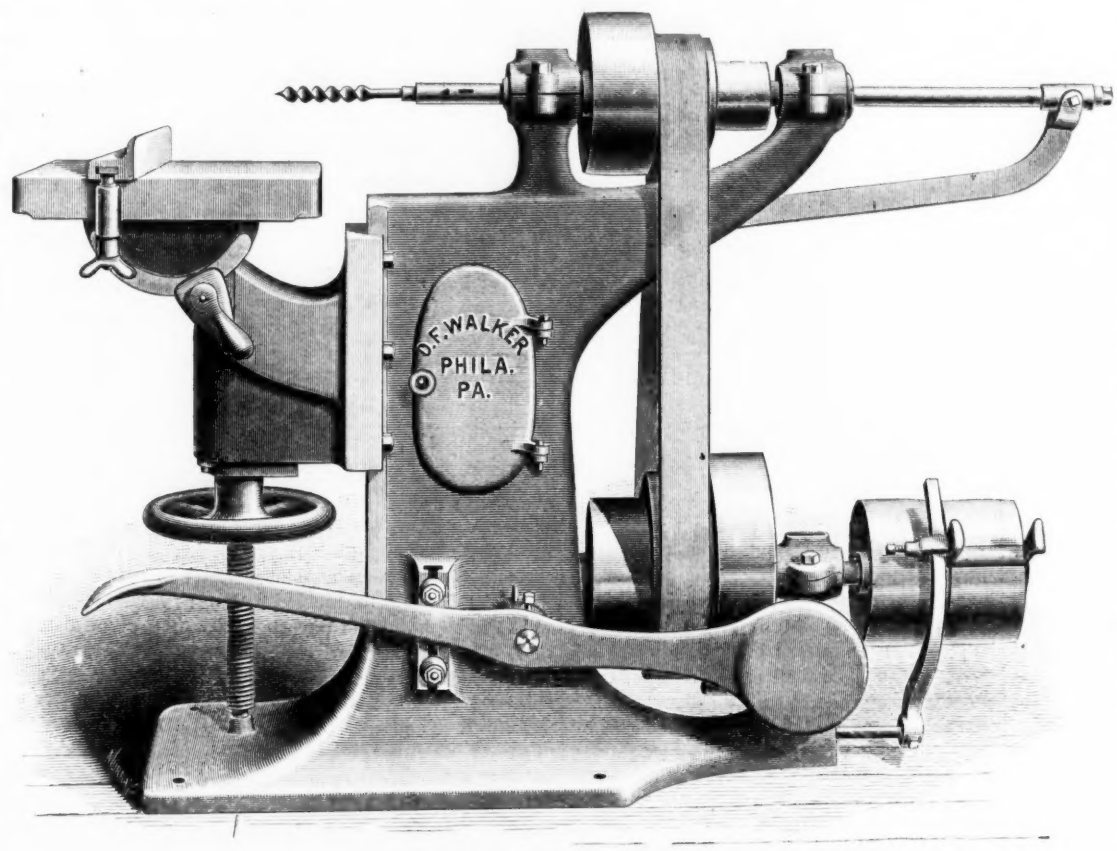
It certainly is a most fascinating subject, leading us so much further into the unknown, and presenting high tension currents in quite a new light as regards danger to life.

Horizontal Boring Machine.

The accompanying illustration represents a new boring machine, which has recently been brought out by D. F. Walker, Front and Canal streets, Philadelphia, Pa.

It will be at once seen that the machine is a very substantial one, and is entirely self-contained.

The spindle has a stroke of 14½", and it will bore a hole in the center of a piece 28" wide. The table can be inclined to any desired angle in either direction, and is very rigidly supported upon the column as well as by a very heavy screw, by which its height is adjusted. The treadle for moving the spindle is counterbalanced, and there is a stop in both directions. Shipper is self-contained, and is worked by the foot of the operator. The machine is, of course, well adapted to work in car shops, or wherever much woodwork is done.



HORIZONTAL BORING MACHINE.

The Main Bearing of the Prentice Lathe.

In our description of the Prentice lathe in our issue of February 18th, we unintentionally did the lathe and its builders an injustice in stating the size of the main bearing to be 2½" diameter and 4½" long. These are the dimensions of the *rear* bearing, those of the main bearing being 3½" diameter, 6" long—quite an essential difference, and one that would be apparent in the strength and wearing qualities of the lathe. It is not so very long since a bearing of the size we mentioned would have been thought sufficient for a lathe of that size in many shops, but that day has gone by.

Fast Trains.

The prevailing ideas regarding railway speeds are very erroneous at any rate. The majority of people, even the most intelligent among those who habitually travel, obtain their conceptions of speed from the figures of the time table, forgetting that in nearly every instance considerable portions of the route must be traversed at much less than the average rate required to cover the total distance in the schedule time. There are very few, if any, of the fast express trains which do not on some part of each "run" reach or exceed a speed of a mile a minute. Yet, by reason of superior railway and well-constructed cars, the accelerated velocity is unnoticed; while running at from sixty to seventy miles an hour the passenger calmly peruses his newspaper or book, children play in the aisle, and a glass brimful of water may be carried from one end to the other of the smoothly-rolling coach without the spilling of a drop....

Would faster trains be dangerous?

No. In the history of railroads no instance can be found where a train has been derailed by reason of running at a high rate of speed. There is no more danger, intrinsically, at one hundred miles an hour than at forty. The dangers to be guarded against bear little or no relation to the question of speed. The strict supervision of tracks and bridges, the abolishment of crossings at grades, the fencing in of all lines of railway, and the prevention of trespassing thereon—above all, an effective system of signals and safeguards for the guidance and protection of trains—these requirements met, the hundred-miles-an hour "flyer" will be a safer conveyance than a city horse car.—*From "One Hundred Miles an Hour," by* CHAS. R. DEACON, *in March Lippincott's.*

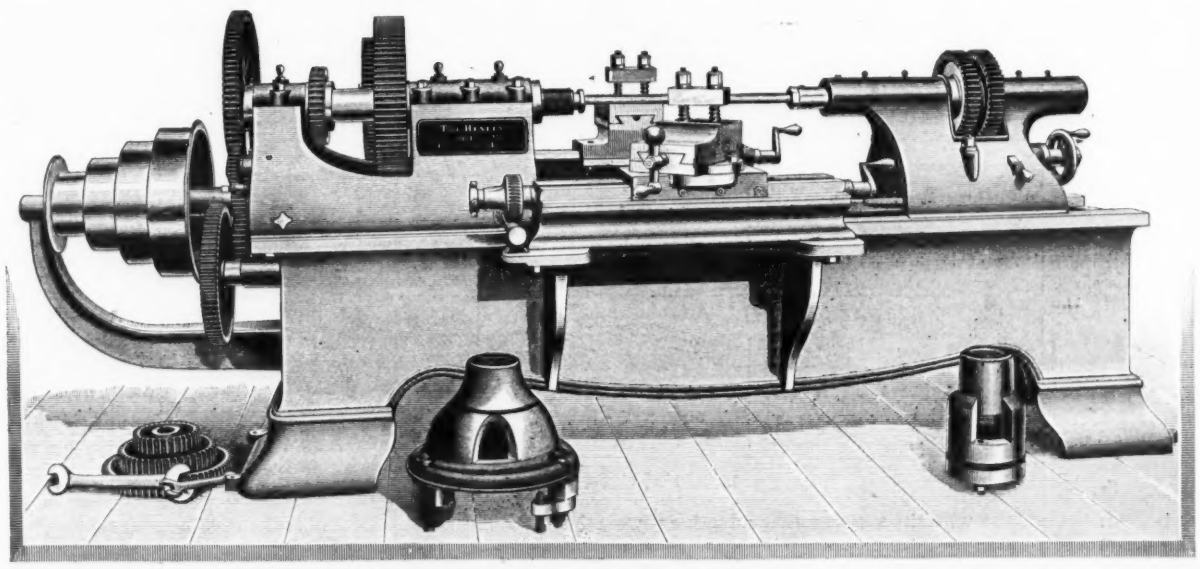
An official list has just been published of the wages paid in Germany to employes on the State railways in that country. These wages are very low compared with those paid in this country, the salaries of the presidents, for instance, being but little over $2,500 a year—an amount which would scarcely keep the average American railroad president in loose packet change. The salaries of other employes of the road are in proportion, and yet it is altogether probable that the service performed by railroads in this country is performed at less cost than in Germany.

The proprietors of the *Dundee* [Scotland] *Courier* and the *Dundee Weekly News* have ordered from Messrs. Hoe & Co., of New York and London, to be built at the latter place, a large quadruple printing press, which will be the first of its kind in Europe, and will contain all the latest improvements applied to printing machines on both sides of the Atlantic.

It will print, fold, deliver and count papers of 4, 6, 8, 10, 12, 16, 20 and 24 pages, *Courier or Weekly News*, at the rate of 50,000 eight page papers per hour, or double the rate of any machine now running in the country.

Improved Thirty-inch Pulley Lathe.

We illustrate herewith the latest form of a pulley lathe which has won its way to favor in many shops where much pulley or similar work is done, since it bores and turns the pulley at the same time, and is so arranged that both operations are performed in a very efficient manner, the boring bar being driven at the proper speed independent of the motion of the pulley, and two tools being used simultaneously for turning.



IMPROVED THIRTY-INCH PULLEY LATHE.

The particular lathe illustrated is for pulleys from 8" to 30" diameter and 20" face, the pulleys being chucked in a special chuck which holds them by the arms upon a convex face, so arranged that the points of contact of the arms come directly under the clamps, so that no springing can occur. For the range of sizes named above two chucks are used which are fitted to the spindle in the usual manner.

The spindle is of steel 3 5/16" diameter, 31¼" long, and having a front bearing 12" long. It is driven by the four-stepped cone seen through the medium of gears proportioned 41 to 1, and so arranged as to give a wide range of speeds. The cone is for a 3½" belt.

The spindle is bored out for the reception of the boring bar, the hole being 1¾" diameter, 14" deep, with provision at the outer end for the reception of a bushing which fits the bar and prevents it being deflected by heavy cuts, thus insuring the truth of the bore with the turned rim. There are six changes of speed for the bar, and it revolves in the opposite direction to that of the main spindle.

The bar is revolved by gears which are driven from a shaft which extends through the center of the bed, the foot-stock spindle having a square thread cut upon it, to which is fitted one of the gears seen, while the other does the driving. As the gear which is fitted to the thread is slightly smaller than the driving gear it revolves faster, and thus the feed is obtained. The bar can also be fed by hand by releasing a friction and turning the hand wheel seen at the back of the foot-stock. The mechanism here will be understood from an inspection of a detailed engraving published by us in our issue of July 10, 1890. The boring bar is 1 7/8" diameter, 32½" long, and will bore 12" deep.

The tool saddles are fed by worm gear and screw motion, can be set to any desired degree of taper, in addition to which the rest on the front of the lathe is compound, and can be set to any desired angle. The rails upon which the saddles are fitted are 30" long, 7" wide, and the saddles have a bearing upon them 12" long. The feed of the turning tools ranges from the finest to ¼".

As to the general proportions of the machine and its adaptability to the purpose for which it was designed, the engraving speaks for itself. The weight is 4 000 pounds, and it is built by the Henley Machine Tool Works, Richmond, Ind.

Those who are interested in the management of boilers and their construction will find many useful notes and data relating to these subjects, and much other interesting reading matter in the bound volumes of the monthly journal, *The Locomotive*, for 1891. They are now issued in their usual neat and attractive form by the publishers, the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn. Price, $1.

Work at the Washington Navy Yard.

A visit to the Washington Navy Yard, which is now converted into an ordnance yard, will repay any one who is interested in excellent and exact workmanship. Skillful mechanics are employed, and all do as good a day's work as is done in any private establishment, which, in connection with the great amount of work on hand, give the shops a very busy appearance. The shops are equipped with the best and latest improved tools, to which are now being added large lathes for the production of 13, 14 and 16 inch guns. The last of four 12-inch guns, each weighing fifty tons, is about completed, and forgings for a 13 inch gun, which will weigh sixty-five tons, are expected. A large number of guns of smaller caliber have already been turned out, and experiments at the Government proving grounds have given ample evidence that the guns are as efficient as they are well made. The Navy Department deserves great credit for the rapid progress that has been made in this branch of industry, and should this country ever be compelled to put its guns to a practical test, the result will undoubtedly be such as to show the wisdom of the recent reorganization of this part of the ordnance department.

LETTERS FROM PRACTICAL MEN.

Safety Sentinel for Automatic Gear Cutters.

Editor American Machinist:

An automatic gear cutter is likely to make a miss now and then in spacing, and when the miss is made the gear blank is spoiled.

Figs. 1 and 2 illustrate a device that I have had in use for a number of years to prevent this trouble.

A sentinel rod (*S*) is mounted in a bearing alongside of the cutter, and so adjusted that its point just passes into the tooth space next to the one the cutter is at work on. The outer end of the rod has a hook that passes through an eye, and holds the end of a cord or chain which leads to the spring shipper, or to a bell.

If now, as in Fig. 2, the blank has been correctly spaced, the end of the sentinel rod will pass into the tooth space before the cutter begins on the next one. But if there has been a slip, if the gear blank has loosened, or stuck, or the spacer failed to act, the sentinel will not pass into the tooth space, but will strike the edge and be forced back. The hook is thus withdrawn through the eye, and the cord slips off and rings a bell, or throws the driving belt onto the loose pulley. GEORGE B. GRANT.

Lexington, Mass.

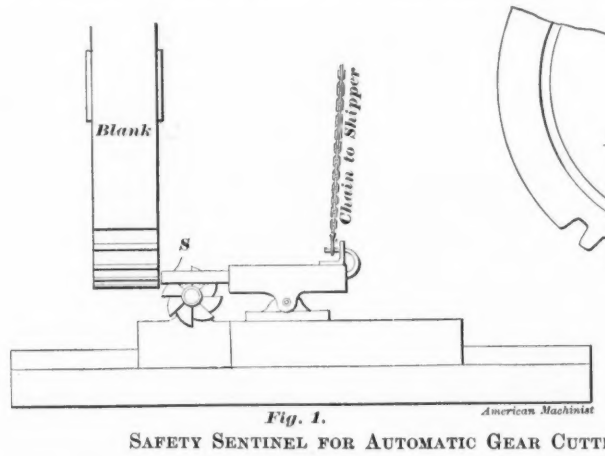


Fig. 1.

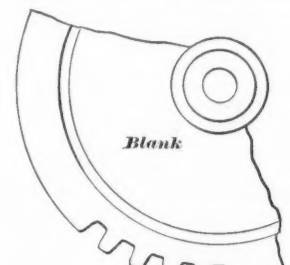


Fig. 2.

SAFETY SENTINEL FOR AUTOMATIC GEAR CUTTERS.

16″x26″x60″ vs. 18″x22″x68″.

Editor American Machinist:

It is not without a feeling that perhaps there has been too much already written about these two locomotives that I recur to them again; but the subject is important as well as interesting, and the truth regarding the points in controversy should be known. Besides, I wish to correct an error in my letter in your issue of December 3, 1891; but of this later on.

Referring to Mr. Clough's letter in your issue of February 4, I wish first of all to say that I am not prejudiced in favor of long stroke or any other kind of engine. In purchasing an engine the one is selected that will best fit the conditions and requirements. Prejudice and "prophecy" have no business in the selection of an engine. If he can show me whereby I can gain 25 per cent. in power by changing an engine 16″x 26″x60″ pulley to one 18″x22″x68″ pulley, I will "catch on" instantly; but I want something beside sentiment and "prophecy" to back me when I make the "catch." I want some indicator cards or other tangible evidence of the deficiency of the one and efficiency of the other. If he cannot furnish this evidence of superiority, then this spavined, stump-tail short stroke hobby should be led right off the track, and out of sight, by the shortest and most direct route. I want it distinctly understood that I do not question his statement regarding the performance of the locomotives, but I do not believe that it was due to the proportioning of the cylinder *per se*, while he does. I believe him to be a perfect gentleman, and his solution of the Allen problem ranks him a mechanic. This plain statement being made, I shall go again for his hobby.

There are so many conditions affecting the efficiency of locomotives that it does not seem fair to dump the whole lot on one little (what he thinks to be) malformation. In order to take these conditions into consideration—which will be necessary to form an intelligent opinion—it will be necessary to have the following questions answered:

Was the initial pressure, point of cut-off, ratio of expansion, point of release, back pressure and compression the same in both engines? If these questions cannot be answered I will substitute the following: Was he same fuel used on each engine? Were the firemen and engineers equally proficient? Was the same pressure carried and maintained on each engine? Were the valves, team passages and valve gearing practically the same in each? In short, were *all the conditions*, whether enumerated or not, equally as favorable for one engine as the other? If they were, I am going to prove beyond a peradventure that the 16″x26″x60″ will pull the most. For this purpose I inclose two sketches, Fig. 1 being a representation of the parts in question of the 16″x 26″x60″, while Fig. 2 represents like parts of the 18″x22″x68″, which will aid very much in making the demonstration both brief and clear. In Fig. 1, for each pound pressure on the piston per square inch we have 201 pounds on the crank-pin, as marked. Of this 201 pounds—when the crank is in the position shown—there are 113.9 pounds of it resisted by the axle, and the remaining 87.1 pounds by the friction caused by the weight of the wheel on the rail. Thus, we have an unbalanced force of 87.1 pounds tending to move the locomotive. If the crank-pin was but one inch above or below the horizontal line, then the unbalanced force tending to move the locomotive would be $\frac{1}{8.6}$ of 201 pounds, or 6.7 pounds for each inch above or below for each pound of average effective pressure on each piston.

Now let us see what Fig. 2 will "show up." Here we have 254.5 pounds on the crank-pin for each pound of pressure on the piston per square inch. Of this, 172.5 pounds is resisted by the axle, and the remaining 82.5 by the friction of the wheel on the rail, giving us an unbalanced force of 82.5 pounds tending to move the locomotive, or $\frac{1}{3.4}$ of 254.5 for each inch the crank-pin is above or below the horizontal line, being nearly 7.5 pounds. Fig. 2 has more pounds per inch, but it has not got so many inches above and below the horizontal line as Fig. 1. So with the same average effective pressure on the pistons per square inch, the same weight on the drivers, then it is evident that Fig. 2 won't move Fig. 1's maximum load.

It may be of interest also to state that Fig. 1 will use more steam in running the same distance that Fig. 2 will, this fact being a very strong reason why it should pull the heaviest load. For instance, Fig. 1 will make 336 revolutions per mile, and if the engines cut off at half stroke each cylinder will use 336 cylinders full of steam per mile. The displacement of a 16″x26″ piston is very nearly 3.02 cubic feet, which, being multiplied by 336, gives us 1014.72 cubic feet of steam per cylinder per mile run, while for Fig. 2 we have a piston displacement of 3.24 cubic feet per revolution per cylinder, and 291 revolutions per mile, or 942.84 cubic feet of steam per cylinder per mile run. If Fig. 2 does 25 per cent. more work with same pressure, point of cut-off, etc., it is also more economical in the use of steam to an extent that will give compounding a close call.

I hope Mr. Clough will continue to favor you with papers on this important topic, giving among other things his proportion of the various parts of an ideal locomotive for any branch of service. They are made now in almost every imaginable proportion, but there is "lots of room at the top."

Now, referring to the error that I spoke of at the beginning of this letter, I will say that, after reading Mr. Clough's article in one of your October issues, I formed the opinion by reading the article that he was unduly favoring short stroke engines; and to see what grounds there were for the 18″x 22″x68″ doing so much more work than the 16″x26″x60″, I sought Nystrom's Pocket-book for a formula by which I could calculate the power of each, and then make the comparison. I found the formula, and used it in the calculations of these engines in your issue of December 3. I have had the most implicit confidence in the formula in Nystrom's Pocket-book, and do not remember of having found an error before. I discovered the error about a week after writing the letter (appearing December 3), in looking up the same topic in Trautwine's Engineers' Pocket-book, where a different formula is given. Nystrom's formula given in words is: Multiply the area of one piston by the stroke in inches, and by the average effective pressure in pounds per square inch, and divide by the diameter of the driving wheel, the quotient being the tractive force of the locomotive. Trautwine's formula is the same, except he uses the *square of the diameter of one piston* instead of the *area*, as Nystrom does.

It will be found that Nystrom's formula gives the same results as I have shown in Figs. 1 and 2; but those were not given for accuracy, but to show clearly the effectiveness of each engine. They are, however, practically correct for the position in which the crank is shown. To make the error manifest, suppose we move the locomotive till the crank-pin of the engine on the other side of the locomotive is two inches above or below the center, giving us 15 pounds effective force per each pound pressure per square inch on the piston of that engine, while the crank-pin of the engine on this side of the locomotive has moved but about $\frac{3}{16}$″ *vertically*, so while we have gained 15 pounds on the one side we have lost but 1.5 pounds on the other. If we multiply the area of both cylinders by the distance in inches that one of the pistons travels while the wheels make a revolution, and divide the product by the circumference of the wheels, there can be no doubt but the quotient will be the tractive efficiency of the locomotive for each pound average effective pressure per square inch on the pistons; and, as Trautwine's formula gives the same result, it, too, must be correct. Applying Trautwine's formula to the 16″x26″x60″, allowing an effective pressure of 50 pounds per square inch throughout the stroke, we have $\frac{256 \times 26 \times 50}{60} = 5{,}546+$ pounds, while for the 18″x22″x68″ with the same average effective pressure, we have $\frac{324 \times 22 \times 50}{68} =$ 5,241 pounds. Nystrom's formula will give for the former $\frac{201 \times 26 \times 50}{60} = 4{,}355$ pounds, and the latter $\frac{254.5'' \times 22'' \times 50''}{68''}$ 4,117 pounds.

Applying Trautwine's formula to the third type of locomotive spoken of in your February 4 issue, we have a tractive efficiency of $\frac{324 \times 22 \times 50}{60} = 5{,}490$ pounds. Again, taking the New Jersey locomotives he speaks of, with cylinders 16″x24″ and 68″ wheels, we have $\frac{256 \times 24 \times 50}{68} = 4{,}513$ pounds tractive efficiency. He could well risk his reputation as a prophet by saying that these N. J.'s would get left, as a freight engine.

On page 808 of Trautwine's Pocket-book he gives a table of the performance of Baldwin locomotives, and I am sorry to say that they do not show the efficiency that those Mr. C. speaks of do. In the table spoken of, locomotives with cylinders 18″x22″, with wheels from 61″ to 66″, are given a load of but 395 tons on a grade of 52.8 feet per mile.

Mr. Trautwine treats this subject and many others very exhaustively for a work of the kind to contain, and I have no doubt authoritatively as well.

Again allow me to ask Mr. Clough what pressure they carried on his locomotives, as well as the other data asked for.

C. O. SINE.

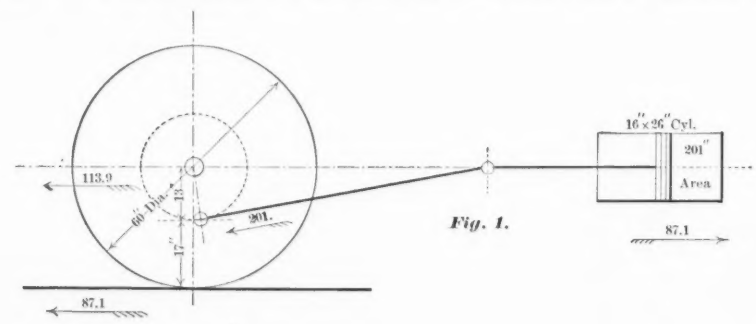


Fig. 1.

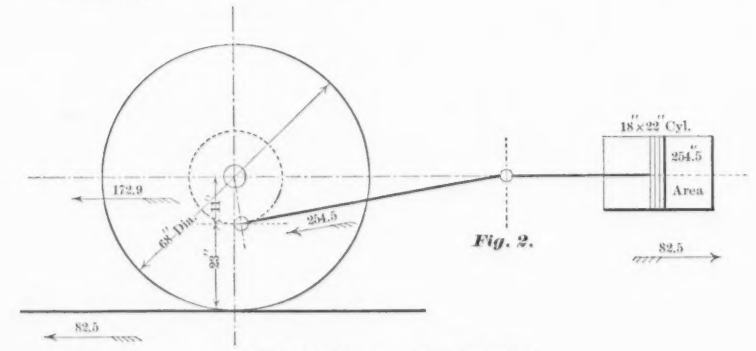


Fig. 2.

16″x26″x60″ vs. 18″x22″x68″

Corliss Beds on Slide Valve Engines.

Editor American Machinist:

I notice in your Jan. 7, Machine Design by Prof. J. E. Sweet, this statement: "that while the design of the Corliss engine bed was as applicable to slide valve engines as the original type, no one seems to adapt it to that class," etc., etc. I inclose a cut which I think will enlighten some one on this point, as this company has built this style for a number of years. W. N. B.

[The cut referred to is of an engine built by C. & G. Cooper & Co., of Mt. Vernon, Ohio—slide valve engine with Corliss bed. —ED.]

Size of Drawing Paper.

Editor American Machinist:

I have a suggestion to offer that may aid some one in selecting sizes for standard drawings.

In your answer to Question 5, January 7, you recommend 10x15 and 15x20″, and on January 28 Mr. Schaefer mentions 18x24″ and 24x36″. A large and well-regulated shop in Hartford, Conn., uses sizes 13x19½, 19½x26, and 26x39″, while Uncle Sam insists on having patent drawings 10″x15″.

From the above, and others that might be mentioned, it appears that the proper relation

of the width of a sheet to its length is somewhere between 2 : 3 and 3 : 4. Now I suggest that we adopt a mean between these two, and make different sizes proportional to each other. Why not 10x14, 14x20, and 20 x28", or, if these are too small, use 10½x15, 15 x21, and 21x30"? In Mr. Schaefer's case, perhaps, 13x18, 18x26, and 26x36" would answer. I have been using for some time sizes 12x17, 17x24 and 24x34", and find them convenient for my work. Almost all details go on the 12x17 sheets, and the tracings are kept in a portfolio in the safe. RIGGS.

Toledo, O.

A Mechanical Problem.

BY A. D. PENTZ.

The tool room of a manufactory is practically a jobbing shop as far as variety of work is concerned, and no one can tell what next will be demanded from the tools or the men.

I am free to say that the tool room is the sole practical educational feature which will in the next arrangement of things be left to perpetuate that class of American machinists who have been a source of pride to their country and of envy in other lands. In no other place will any thought of how to do a job of work be a necessity. Tools with which boys, girls and greenhorns can do the most delicate and involved operations have been made, are being improved, and will be infinitely extended until the necessity for neither hand work nor brain work will be required of operatives to produce the best grades of manufactures that were ever made, so that in no other places but tool rooms will there any more be a necessity for good mechanics, and it will be right in the end that it is to be so. Of course in the upheaval which seems imminent there will be misery and suffering, enforced idleness of employes will increase and produce a condition which will have to be met. It will be met either by a new patch or a new garment; then a new start will be made, which, it is to be hoped, will be in a forward direction.

The problems which continually arise in tool rooms have to be solved as those which have arisen in the jobbing shops were solved, by study; and the practice of continually solving these problems has been the chief stimulus to the improvement in machine tools for which we, as a manufacturing people, have gained an enviable renown.

In the study of how to produce one certain tool to the best advantage, there arise an entirely different set of propositions from those to be considered in the study of how to produce a thousand duplicate parts of a machine or other thing to be made by a tool or set of tools. In the production of the tool itself, ordinarily the prime consideration is the accuracy of its special features. If it be a drill jig, precision in the seat for the piece to be drilled in it, and accuracy in the sizes and positions of its holes, are of more consequence than a remarkably cheap job is. But in the study of what a jig shall be, which will, when finished, make good and paying work, every item of cost for accessories, every movement of the tool when in use, and each moment of time consumed in placing the piece in the jig, in drilling, in transferring from a position under one drill to one under another drill, and the removal of the piece must be studied and cut down to the lowest point. If fifty per cent. of extra work on a jig for continual use will increase its producing efficiency even one per cent., it ordinarily will pay to do it.

How often in every tool room there arises the question, "Shall it be swung on the face-plate of a lathe, bored in the transverse drill, or in the boring-mill?" And how often is the preference of the old conservative man, to swing it in a lathe, found to be at fault by the result. If the piece be out of balance within itself, a counterweight on the face-plate will not prevent centrifugal deflection when the piece is revolving, and the result will be defective, or at least vary from its truth when at rest. It may be that this error at times has exactly corrected an error in the setting. Some men have miraculous luck. When a piece is in balance there is no tool more satisfactory than a lathe to bore in; after the piece is once set and provided, the lathe bores a parallel hole. But the money that has been wasted in paying for time consumed in getting work in dead truth on lathes, and explaining the holes afterward, already this year, could buy at least one boring machine that can do a satis factory job.

Most holes are more profitably transferred from the models than laid out on the surfaces of jigs and bored. There is so much to be said in this relation, however, that it may well make of itself the subject for an entire article.

Sometimes the tool maker or the jobber is given a piece of work to be done that has no outline satisfactory to work from. To illustrate this idea, I have made a sketch of a hypothetical job which has all the points of one we had to do about two years ago. I do not illustrate the actual piece, because the job was never satisfactorily paid for, and I won't advertise its owner; besides, its outline has escaped my memory, so that I could not depend on exactly reproducing it.

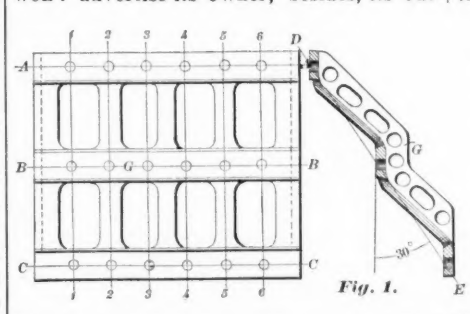


Fig. 1.

The casting *G* is about three feet wide and three and a half feet long. It has three planed surfaces, each of which has a different height, but they are parallel to each other in every way. Through each of these surfaces there are bored six holes, and these holes are situated on the lines *A*, *B* and *C*, and at their junctions with the cross lines 1, 2, 3, 4, 5 and 6. These holes are required to be square with the surfaces they penetrate, (which, of course, makes them parallel to each other) to center exactly on the lines *A*, *B* and *C*, as well as on the cross-lines, which must be at exact right angles to the others. The edges are rough, and are to remain so. The job is to be done in a hurry, and not cost much, as is the case with all jobbing work.

It may be done thus: If your planer is a good one, that is, if the housings are perpendicular and the rail is square to the platen, attach the piece to the platen parallel to the plane indicated by the line *D E*, and fasten securely. Then at sixty degrees from the vertical, with the angle feed, make the three parallel planes on which the lines *A*, *B* and *C* are shown. The height of one of these planes from the others may, of course, be found by a surface gauge, and there should be the same height from the middle one to the upper one as from the lower one to the middle one. When these surfaces are satisfactory, then with a sharp-pointed tool scratch the lines *A*, *B* and *C* very faintly, but with certainty. This tool is not to be elevated nor depressed, but simply kept at the same height, and moved after cutting the line *A* when clear of one end of the casting to the place to cut the line *B*, and then to the place to cut the line *C*. These lines will indicate the positions of the holes parallel to each other, and equidistant in the width dimension.

Now on the line *A*, with dividers set to the required length, mark the places for the cross-lines 1, 2, 3, 4, 5, 6. Then with both the toolfall and slide set vertically, place within the tool clamps a parallel piece which has one corner beveled so that it comes into parallel contact with the planed surfaces on the piece *G*—that is, so that it shall lie across the lines *A*, *B*, and *C* like a straightedge. Then with this edge placed at the point 1, made by the dividers on the lines *A*, scratch with a hard point across that line. Then lift the fall and move the crosshead to where it will place the edge against the line *B* and scratch there, and then move to the line *C* and repeat. Thus all the intersecting points may correctly be found.

After the holes in the piece are thus located they may be laid out by pricked circles as usual, or they may be drilled through a jig of a novel design which I will describe and illustrate. This jig will be found to be of value in drilling all holes which need to be square with (vertical to) the planes they pierce.

The stock *A* is a casting bored to receive the bushing *B*, and faced on the seat *F*, and under the shoulder of the bushing. This bushing will perhaps be for a drill two inches in diameter. It is designed to be turned within the stock *A*, and the drill will fit this bushing snugly and turn it by the dog-pin *C*. The intention in this is to preserve the inside of the bushing from wear by the sharp edges of the drill at the grooves.

The bushing *B* is kept down by the cap *D*, which is secured by the screw *E*. This cap is arranged to be turned partly about when the screw *E* is loosened, so that this bushing may be taken out and one of another size put in. It is designed that one of these jigs will accommodate all sizes of drills from one-quarter inch to one-half, and that four sizes of these jigs will take all drills from one quarter inch to two inches, if there be proper-sized bushings.

This jig is clamped to a face through which a hole is to be drilled on its face *F*. This can be either by screw clamp or by bolts and straps.

When the jig is placed the bushing *B* will be removed, and the center plug *I*, Fig. 4, will be inserted. This center plug fits the hole occupied by the bushing, and, of course, the center point *K* will, if it shall exactly cover the center of the proposed hole, position the jig as it is intended to be set. The center plug is cut away at *D* to assist the view, and the stock *A* is similarly cut at *H* for the same purpose. If then it be secured to that place and a hole drilled through the bushing into the surface below, that hole will be concentric to the point the jig was positioned to.

It is recommended that the bushings *B* shall cover a large part of the length of a drill it may guide; that straight shanked drills be used, and that they be driven by dogs, so that the drill spindle shall rotate and feed them, but not affect the alignment to disturb it.

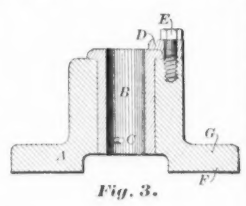


Fig. 3.

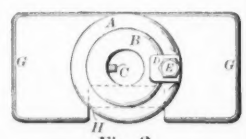


Fig. 2.

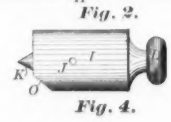


Fig. 4.

A crank hand power could well be applied to this device and increase its capacity, or it could be provided with a belt power driver and a power feed. In both these cases it could be made portable and used independent of a drill press in any suitable location.

Returning to planers, it is my practice to lay out a considerable amount of irregular work both for holes and the position and sizes of other features on planers on the plan indicated above. I find it to be a quick method and a reliable one, but I also find that but few iron planers have either the rail square with the platen or the housings vertical to it. I will suggest, if this method of laying out work be found to be as good as I believe it to be, that an effort be made to induce the makers of planers to place the housings square and perpendicular to the motion of the platen.

The *Shoe and Leather Reporter Annual* for 1892 has just been issued. Those who wish to know something of the facts and figures relating to the shoe and leather trade, and possess a good directory of the boot and shoe manufacturers and dealers, tanners, dealers in leather and findings, hides, furs and wool, harness manufacturers and dealers, manufacturers of machinery, etc., in the United States and Canada, and prominent firms in other parts of the world, cannot do better than procure a copy of the *Annual*. The New York office is at 17 Spruce street.

We have received the following letter from an established firm of machinery dealers whose location is given. We publish it because it expresses a good deal of common sense on the subject that it treats of. It is our opinion—in which we may be wrong, as every one is liable to be—that with fine sets of taps and dies a tap wrench should go as a component part of the complement. However, we let our correspondents state that side of the question, as they undoubtedly do it better than we can. They write:

We think it very strange that the manufacturers of screw plates who put their goods up in very neat and convenient cases continue to overlook the fact that a *tap wrench* is just as essential to a complete set of taps and dies as the stock for holding the dies; and, as dealers, we find that, after we have made a sale of a set, then we have the whole ground to go over again with the customer to sell him a tap wrench, and are invariably met with the remark, "Why, that goes with this set, of course," and he will not pay the extra price, and it is hard to dispute his statement that the wrench should go with the set, and a place should be provided for it in the box with the other tools.

We believe that through the medium of your valuable paper this can be corrected, if you agree with us in our criticism. It will work to the advantage of the maker of the goods, as he will sell more tap wrenches than he does now.

CALLENDER & PATTERSON.

Dayton, Ohio.

In one of the latest forms of electric roads, overhead wires, and, in fact, continuous conductors of any kind are not used, but instead there are what are called "heads," which are placed between the rails about 12 feet apart, the electricity being taken from these. The distance from one head to the other is so proportioned with regard to the length of the car, that just as contact is about to be lost with a given head it is made with the next one, so that the contact is continuous. It is claimed that the plan works well, and does away with all danger to life. A trial of the scheme was made a short time ago at Coney Island, which was pronounced to be very satisfactory. A company called the American Engineering Company made the experiment, and claims to control the patents upon it, but Mr. G. T. Wood, a well-known electrician and mechanic, claims that all the company has that is of value in the matter it obtained from him through fraud, and there is likely to be a contest over the matter.

Mr. Wood, by the way, is a colored man—a full-blooded negro, born in Australia. At ten years of age he was apprenticed to a blacksmith, and afterwards learned the machinist's trade, taking lessons at a night school. He finally took up the study of electricity, and received two years' instruction at a technical school. He was then engineer on a British steamer, but now devotes his time to electrical matters.

The following is said to be a copy of a notice to be seen on a railway:

"Hereafter, when trains moving in an opposite direction are approaching each other on separate lines, conductors and engineers will be required to bring their respective trains to a dead halt before the point of meeting, and be very careful not to proceed until each train has passed the other."

Last week in quoting from a letter of the Egan Company, of Cincinnati, the types made us say that they had built a band resawing machine that had made a record of 3,868 feet of 7"x12" lumber in 56 minutes. This is a mistake and might be misleading. We meant to say 1"x12" lumber.

Mr. T. R. Almond has been awarded the Scott Medal by the Franklin Institute for his angular coupling.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

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$4.00 a year to Other Countries, postage prepaid.

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"Business Specials," 50c. a line.

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The Wisconsin News Company, Milwaukee, Wis.

The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., or Stefanstrasse 18, LEIPZIG, GERMANY, will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.
Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 20 francs per annum, postpaid.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne,

NEW YORK, MARCH 3, 1892

CONTENTS.

	PAGE
Drill Press Arranged for Boring	1
Designing New Machinery. By Henry B. Morris.	1, 2
An Improved Rifling Machine. By Prof. Frederic R. Honey	2, 3
Thirteen inch Drill Press	3
Plain Milling Machine	3, 4
The Buffalo "B" Volume Blowers.	4
Hand Pipe Threading and Cutting Machine	4
High Potential Electricity	4
Horizontal Boring Machine	5
The Main Bearing of the Prentice Lathe	5
Fast Trains	5
Improved Thirty-inch Pulley Lathe	5
Work at the Washington Navy Yard	5
Letters from Practical Men: Safety Sentinel for Automatic Gear Cutters. By George B. Grant.. 16"x26"x60" *vs.* 18"x22' x68". By C. O. Sine....Corliss Beds on Slide Valve Engines. By W. N. B....Size of Drawing Paper. By Riggs	6, 7
A Mechanical Problem. By A. D. Pentz	7
Space in Machinery Hall in Chicago	8
Literary Notes	8, 9
Questions and Answers	9
Practical Details of Blacksmithing—Making Metal Wheels. By B. F. Spalding	9, 10
Steam Pressure and Horse-power Indicator	10
Manufactures	10, 11
Machinists' Supplies and Iron	11

Space in Machinery Hall in Chicago.

It is becoming evident that those upon whom the responsibility rests for the assignment of space in Machinery Hall at Chicago have a task before them of no mean proportions.

The total space in the building is in round numbers 656,000 square feet of floor, and it is expected by those who are in a position to know something of the matter, that there will be about 3,000 applications for space. This would give to each exhibitor about 218 square feet of floor space, or say a space 10 feet wide by 22 feet long. It is of course evident that while this space would be ample for some exhibitors, it would be utterly inadequate for others who, unless they could obtain much more than this, would not consider it worth while to make an exhibit at all, and it will therefore be necessary to come upon some plan for satisfactory apportionment. Applications are coming in quite rapidly, and the impression seems to be quite general among machinery manufacturers that there is going to be a considerable shortage of room in which to do themselves justice.

It is evident from what we have been able to ascertain regarding the applications so far made that there will be a shortage, and that there is a liability of considerable dissatisfaction in the matter unless it is managed with the greatest possible skill.

The chief trouble seems to be at present, that some applications are being made upon the supposition that there will be a scaling down, and that the proper plan is to allow for this in making the application, so that after the scaling has been done there will still be all that is needed. If some manufacturers do this while others apply for only the space actually needed, and then the scaling is done in proportion to the space asked for, instead of in proportion to that which it can be shown is actually needed, it is evident that there will be just cause for complaint.

The main difficulty would be in such a plan of uniform scaling down, that all manufacturers will not apply for space in proportion to what they can actually make use of for the good of the exhibition, but in proportion to what they can make use of for their own good, and many of them will undoubtedly be influenced only by a desire to have a bigger display than any competitor, even though there be plenty of competitors whose line of machinery would logically call for a much larger space and a much better display.

We know of one concern, which is undoubtedly one of the most prominent in its line of machinery in the world, which applied for a certain space after a systematic study of what would be necessary to make an adequate exhibit of its products, and with the intention to apply for no more space than actually necessary; not to show specimens of all the machinery built by them, but merely to give visitors an adequate idea of it by showing representatives of types or classes. Another concern, building simply one of the many lines of machinery built by the first mentioned establishment, and that in comparatively a very small way—a concern which any one versed in such matters would say could make an adequate display in less than one-fourth the space, applied for more than twice the space. It is evident that a proportionate scaling down would not be to the interest of the exhibition, in these cases at least. In another line of machinery, it is announced that a firm of manufacturers, by no means the most prominent in its line, has applied for nearly one hundred times the space above mentioned, as being available as an average for each exhibitor. It may be that this firm needs, and can use to good advantage all the space it has applied for, but knowing something of the matter, we should be inclined to think that the advertising feature, and the desire to have a more noticeable display than any competitor, were the chief motives.

Of course there is no way for the managers at Chicago to arrive at the exact facts with regard to these matters. It would be manifestly unfair to cut down all applications say 50 per cent., and it would be equally unfair to base the decision as to the amount of space allowed upon the relative prominence or amount of business done by a concern making application. A new concern just starting, and having scarcely any reputation or business, might be able to make an exhibit that would far surpass that of an older concern with a world wide reputation. We are informed from a reliable source that it is the present intention to scale down applications proportionately, but for the reasons given above, we do not think this will work very well.

It seems to us that a more just plan, and one which will in the end work better for the exhibition as well as for exhibitors, would be to require each applicant for space to specify just what machines it was intended to exhibit, with sketches, photographs, engravings or blue prints of each so far as possible. And with these to furnish a complete list or catalogue, so that an idea might be formed as to the proportion of the total line of machinery built it was desired to exhibit, the reasons for desiring to show each machine being given in full. Such applications made in this form might then be acted upon intelligently, and the amount of space allowed in each case proportioned so far as possible to actual needs regardless of any other consideration.

We are informed that no assignments of space will be made before June or July, as it is not expected that sufficient applications will be in before that time to give an idea of the space available for each exhibitor, and the longer applications are delayed, the later will the assignments of space be made. Applications already received ask for more than 300,000 square feet of space.

In a recent issue of the *Engineering and Mining Journal* we find an attempted explanation of the coupon book advertisement to which we referred in our issue of January 28. The explanation, however, does not explain, for the reason that it does not consist with the claims made for the coupons by the advertiser, either in the original advertisement or in its present modified form. Our esteemed contemporary says that as a matter of fact the coupons do not give control of "the patronage of your hands," which statement it seems to us is rather hard on the manufacturer, for he distinctly claimed that his coupons did give such control, though he no longer makes that claim in terms. But if they do not give such control, then why is the fact that they are non-transferable made so prominent? Why does our contemporary say that "They are simply orders in convenient form, which men *can* use at a store," when, as a matter of fact, they are, and are intended to be checks which *must* be used at one certain store and nowhere else, and by the person to whom they are issued, and by no one else?

The fact is that the whole system of "pluck me stores," of which these coupons are intended to be a part, has been condemned by every fair minded and disinterested person who has ever investigated it, and laws have been passed against it in some States—laws which are regularly violated by many mining companies. When a man has earned his wages they should be paid to him in money, so that he can make such use of them as seems best to him. Anything less than this is degrading to the wage-earner, and is a disreputable business, in which we regret to see so excellent a paper as the *Engineering and Mining Journal* taking any part whatever.

According to press reports, an engineer named Clark, who was in charge of a refrigerating plant at Chicago, did a very foolish thing on the night of February 15, when he lifted a cover from a nearly empty oil tank and pushed his lantern down into it to see how much oil remained. The result was an explosion which wrecked the plant and may cost Clark his life.

It seems to us that every intelligent engineer ought to know by this time that the vapor of oil mixed with air is highly explosive, and that if a flame is brought into contact with it there will immediately be trouble. Not long since a frightful explosion occurred in an oil tank steamer, caused by men going into the hold to make repairs and carrying lights with them. The oil, which adhered to the sides of the tank, had evaporated sufficiently to fill it with the vapor mixed with air, a combination which is always dangerous.

If the inhabitants of any country should from any cause sit down and remain at home all the time they would soon lapse into a state of barbarism. Civilization itself depends largely upon social and business intercourse, the interchange of ideas and commodities, and anything which adds to the facilities for doing this is of importance to machinery interests, to business of all kinds and to humanity generally. It is for these reasons that we are able to commend heartily the work of Col. Albert A. Pope, who is at the head of the Pope Mfg. Co. He has founded the department of road construction in the Massachusetts Institute of Technology, and the Pope Mfg. Co, of Boston, now offer as prizes $10,000 worth of bicycles to students who will write the best essays on "Good Roads." We suppose a broad interpretation will be given the term "students," at least we hope so, and particulars can be obtained by addressing the company. Of course the company is not making this offer from purely philanthropic motives, but it is a good thing nevertheless, and we are glad to be able to help our readers to take part in the competition.

The postal authorities have, it seems, decided that printed matter which is made to imitate type-writing so closely as to prevent it from being readily distinguished from type-written matter, must pay full rates of postage as though actually type-written. We know of a typewriter, not yet on the market, which produces a type-written sheet in such close imitation of a printed one that they are not readily distinguishable. On the principle that a good rule should work both ways, should not letters written on this typewriter be mailable at printed matter rates?

Literary Notes.

THE MECHANICAL ENGINEER'S POCKET-BOOK OF TABLES, FORMULAS, RULES AND DATA. A Handy Book of Reference for Daily Use in Engineering Practice. By D. Kinnear Clark, M. Inst., C. E.; Hon. Mem. American Society of Mechanical Engineers; Author of Railway Machinery; Tramways; The Steam Engine; A Manual of Rules, Tables and Data, etc.

This neat little pocket-book of 656 pages has been expressly compiled for the use of mechanical engineers. It contains about 500 formulas and rules, with data of general utility, classified for ready reference. Heat and its application are considered in various aspects. For the strength of materials a variety of experimental evidence is given, with new formulas and tables. Much useful information will be found in the notes relating to wire and hemp ropes; chains and chain cables; framing; mill gearing, shafting, etc.; transmission of motive power to great distances; combustion, fuels; warming, ventilation; steam; steam engines and boilers; railways; tramways; steamships; pumping, steam engines and pumps; coal gas; air in motion; compressed air; hot air engines; water-power and electrical engineering. The book contains 342 tables, giving English weights and measures, with metric equivalents; metric weights and measures, with equivalent English values; weights and strength of bars, sheets, beams, joists, girders, tubes, pipes, bolts and nuts, cylinders, nails, chains, and others relating to the principal branches of mechanical practice.

The character of the contents needs no comment. The author is an engineer of many years' experience, and of unsurpassed distinction in his profession. A work coming from his hands may be considered reliable and worthy of the confidence of engineers and practical men. The book will undoubtedly have a merited wide circulation. It is

published by D. Van Nostrand Company, 23 Murray and 27 Warren streets, New York. Price, $3.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(76) Iron Pattern, Buffalo, N. Y., asks: What can I put on iron patterns to prevent them from rusting, and to give them a skin equal to varnish on wood? *A.*—Heat them and rub bees-wax on them.

(77) W. W., Buda, Ill., writes: Please inform me what books to get that will enable me to get some insight into geometry, and which will aid a beginner in mechanical drawing. *A.*—See article treating on "What to Study and How to Study," in our issue of February 19, 1891.

(78) T. B., Troy, N. Y., writes: Please inform me how to obtain a marine engineer's license. I have run engines for about four years. I am 22 years of age, and would like to get on the river. *A.*—Apply at the office of the Board of Supervising Inspectors of Steam Vessels, Post-office Building, New York. You will have to pass an examination.

(79) O. W. G., Alfred Centre, N. Y., writes: You mentioned in one of your issues a book entitled Rubber Hand Stamps and Manipulation of Rubber, by T. O'Conor Sloane. Please give me the address of the publishers, or the address of a book agency from which it may be obtained. Also give the price of the same. *A.*—It is published by Norman W. Henley & Co., 150 Nassau street, New York. Price, $1. It may also be obtained from any dealer in scientific works.

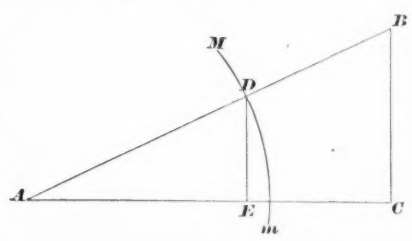
(80) B. R. W., Amenia, N. Y., writes: Please inform me where I can pass an engineer's examination in New York State. Is it possible to pass an examination by mail? *A.*—For an examination for a stationary engineer's license apply at the office of the Inspection of Steam Boilers, Police Department, 300 Mulberry street, New York. For a marine engineer's license apply at the office of the Board of Supervising Inspectors of Steam Vessels, Post-office Building, New York. We believe that examinations by letter are not allowed; however, you can find out by writing to the above addresses.

(81) H. D. H., Brooklyn, N. Y., writes: Kindly inform me if the Washington Navy Yard has a technical school for apprentices. What are the studies? And is a graduate a consulting engineer or not? *A.*—There is no technical school attached to the Washington Navy Yard; it is now converted into an ordnance yard. You are probably thinking of the Naval Academy at Annapolis. For the rules of admission in this institution and studies, see our answer to Question 75, in our issue of February 25. Graduates from technical schools are supposed to have a first-class education for becoming consulting engineers, and with years of experience may become such.

(82) W. L., Corry, Pa., writes: Please answer the following questions through your columns: What wages are paid to machinists in the government machine shops? *A.*—About the same wages as are paid to first-class machinists in private establishments. 2. What are the hours? *A.*—From 8 to 10 hours per day. 3. Would political influence be of any account? *A.*—Yes. 4. Do machinists have to pass an examination? *A.*—For some positions in the navy yards you will have to pass an examination. 5. If I should wish to secure a position as machinist in one of the shops, what would be the best course to pursue? *A.*—We see no other way than to send in your application, or apply in person at any of the navy yards.

(83) G. C. M., Elizabeth, N. J., writes: Kindly inform a constant reader of your paper if there is a method by which varnish can be prepared so as not to make the drawing paper brittle after having applied a coat on the same, which we usually do, to prevent drawings from becoming soiled when going through the hands of the machinist. *A.*—We suppose that you refer to the ordinary shellac varnish as usually mixed in the drawing room. This varnish penetrates the paper and hardens, so that in handling the drawing there is always more or less danger of breaking it; we know of no method to prevent this injurious effect. We have used a special varnish, but its use required a careful sizing of the paper; this operation required too much time, was expensive, and therefore it was abandoned. We have found it advantageous to send blue prints only in the shop; if these get injured they can be replaced with very little labor and cost.

(84) R. L. K., Newark, N. J., writes: I inclose a sketch of a mathematical problem which has puzzled every one to whom it has been shown, hoping you will give me a solution of it. The sketch shows the problem in a condensed form. The sides of the square measure 16 inches, and has a total area of 256 square inches. If the square is cut as outlined in the sketch, and the pieces placed in position as indicated, it will form a rectangle 10 by 26 inches, containing 260 square inches. What puzzles us is where the extra four square inches come from. *A.*—This is an old puzzle of deception. The pieces cannot form a rectangle 10 by 26, because the inclination of one of the sides of trapezoid to that of the opposite one is .4 per inch, and the inclination of the hypothenuse of the right angle triangle is .375 per inch, so that the trapezoid and the triangle cannot form another right angled triangle as you seem to think; it is in this fact that the deception lies.



(85) J. D., Denver, Col., sends us a question relating to a right angle triangle with sides 6, 8 and 10; but the question is so mixed up that we do not know what he really does want. We presume that he wishes to find the angles. Let $A\ B\ C$ be a right angle triangle; and let $M\ m$ be a measuring arc of the angle A described with a radius of 1. Through D, in which the arc $M\ m$ intersects the hypothenuse $A\ B$, draw a line $D\ E$ perpendicular to $A\ C$, then $D\ E$ will be the sine of the angle A. From similar triangles $A\ D\ E$ and $A\ B\ C$ we have $\frac{D\ E}{A\ D} = \frac{B\ C}{A\ B}$; that is, $sin.\ A = \frac{\text{side opposite}}{\text{hypothenuse}}$. Hence if $B\ C = 6$, and $A\ B = 10$, then the sine of the angle A will be $\frac{6}{10} = .6$. Looking for this decimal in a table of natural sines, tangents, etc., we find that the angle A is equal to 36 degrees and 53 minutes very nearly. If the side $A\ C$ is equal to 8, then the sine of the angle B is equal to $\frac{8}{10} = .8$, and referring to the table we find the angle B to contain 53 degrees and 7 minutes very nearly. Your other question we do not understand.

(86) E. H. N., Madison, Wis., writes: Kindly answer through your columns the following: I desire the name of a book or books, and their publishers, covering as completely as may be possible the following subjects: 1, Molding; 2, Pattern Making. The books desired are such as will do for students. *A.*—Molders' Text Book, by Thomas D. West; American Foundry Practice, by the same author; both are published by John Wiley & Sons, 53 East Tenth street, New York. Practical Iron Founding, published by Whittaker & Co., London; this book can be obtained in this country from any dealer in scientific works. Machinery Pattern Making, by P. S. Dingey, published by John Wiley & Sons; Modern Molding and Pattern Making, by J. P. Mullin, published by D. Van Nostrand Company, 23 Murray and 27 Warren streets, New York. 2. Also name a book relating to the design of punching and riveting machinery. If none are published bearing directly upon the subject give the closest thing to it. *A.*—We do not know of any book that treats directly or partially on the subject.

(87) Reader, Mobile, Ala., writes: Please give me your rule for laying out a link for a marine upright plain slide valve engine, especially the method of finding the radius of the link. *A.*—There are several forms of links used. The oldest form of link, the slot link, shown in Fig. 1, is still retained by many engineers. By the term radius of link is meant the radius of the link arc $a\ b$, drawn through the center of the slot; this radius is generally made equal to the distance from the center of shaft to center of the link block pin p when the latter stands midway of its travel. The distance between the centers of the eccentric rod pins $e_1\ e_2$ should not be less than $2\frac{1}{2}$ times the throw of the eccentrics, and, when space will permit, three times the throw of the eccentric will give better results. By the throw of the eccentric we mean twice the eccentricity of the eccentric. The slot link is generally suspended from the end next to the forward eccentric at a point in the link arc prolonged. This will give comparatively a small amount of slip to the link block when the link is in forward gear; but this slip will be increased when the link is in backward gear; this increase of slip is, however, considered of little importance, because marine engines, as a rule, work but very little in the backward gear. When it is necessary that the motion shall be as efficient in backward gear as in forward gear, then the link should be suspended from a point midway between the two eccentric rod pins; in marine engine practice this point is generally located on the link arc; for equal cut-offs it is better to move the point of suspension a small amount towards the eccentrics; how to obtain the exact position of this point under these conditions see our issues of May 10, 17, 24, 31, 1884. For obtaining the dimensions of the link, the following rules may be employed. Multiply the length of the valve by its breadth, all in inches, and multiply this product by the absolute steam pressure in pounds per square inch. Find the square root of this product, and multiply the result by .01. Or in symbols: Let L denote the length of the valve, B the breadth, p the absolute steam pressure per square inch, and let us denote the final result by R, then we have:

$$R = .01 \sqrt{L \times B \times p}.$$

For finding the dimensions proceed as indicated in the following table:

Breadth of the link	$= R \times 1.6$
Thickness T of the bar	$= R \times .8$
Length of sliding block	$= R \times 2.5$
Diameter of eccentric rod pins	$= (R \times .7) + \frac{1}{4}$
Diameter of suspension rod pin	$= (R \times .6) + \frac{1}{4}$
Diameter of suspension rod pin when overhung	$= (R \times .8) + \frac{1}{4}$
Diameter of block pin when overhung	$= R + \frac{1}{4}$
Diameter of block pin when secured at both ends	$= (R \times .8) + \frac{1}{4}$

The length of the link, that is, the distance from a to b measured on a straight line joining the ends of the link arc in the slot, should be such as to allow the center of the link block pin p to be placed in a line with the eccentric rod pins, leaving sufficient room for the slip of the block. An other type of link frequently used in marine engines is the double bar link, and this type is again divided into two classes; one class embraces those links which have the eccentric rod ends as well as the valve spindle end between the bars, as shown in Fig. 2. With these links the travel of the valve is less than the throw of the eccentric. The other class embraces those links, shown in Fig. 3, for which the eccentric rods are made with fork-ends, so as to connect to studs on the outside of the bars, allowing the block to slide to the end of the link, so that the centers of the eccentric rod ends and the block pin are in line when in full gear, making the travel of the valve equal to the throw of the eccentric. The dimensions of these links when the distance between the eccentric rod pins is $2\frac{1}{2}$ to $2\frac{3}{4}$ times the throw of eccentrics can be found as follows:

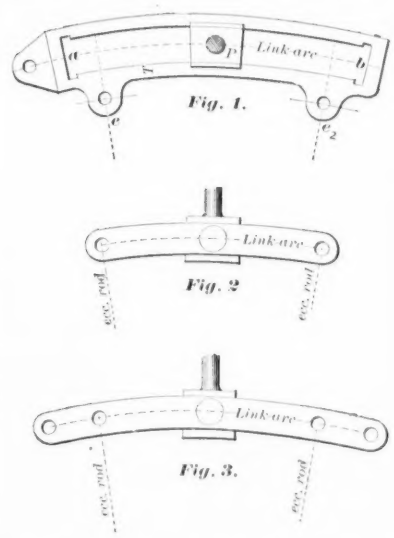


Fig. 1.

Fig. 2

Fig. 3.

Depth of bars	$= (R \times 1.25) + \frac{1}{16}''$
Thickness of bars	$= (R \times .5) + \frac{1}{4}''$
Diameter of center of sliding block	$= R \times 1.3$

When the distance between the eccentric rod pins is equal to 3 or 4 times the throw of the eccentrics, then—

Depth of bars	$= (R \times 1.25) + \frac{3}{4}''$
Thickness of bars	$= (R \times .5) + \frac{1}{4}''$

All the other dimensions may be found by the first table. Of course these are empirical rules, and the results may have to be slightly changed to suit given conditions. It may also be mentioned that in marine engines the eccentric rod ends for all classes of links have adjustable brasses. In locomotives the slot link is usually employed, and in these the pin holes have case-hardened bushes driven into the pin holes, and have no adjustable brasses in the ends of the eccentric rods. The link in Fig. 2 is generally suspended by one of the eccentric rod's pins; and the link in Fig. 3 is suspended by one of the pins in the end of the link, or by one of the eccentric rod pins.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Cat. Improved Breed by Grant. See page 20.
Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
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Your Spring Catalogue. See page 13.
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Save small iron from foundry refuse. It pays Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.
Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.
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Complete treatise on Screws and Screw-making with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St., N. Y.
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31 Nassau street, New York.
Send for Brief History of Patent Legislation.
De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.
"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Practical Details of Blacksmithing—Making Metal Wheels.

BY B. F. SPALDING.

Metal wheels for tramways are probably coexistent with metal tramways. The business of making built-up metal wheels has sprung into vigorous existence within the last decade. There had been some movement towards it previously in making the wheels of steam fire engines and velocipedes (bicycles and tricycles), but anything like supplying the extensive demand for agricultural implements was hardly thought of. What that demand is may be slightly imagined when we read that one establishment—P. P. Mast & Co.—recently shipped 5,000 cultivators at one shipment, thus sending off at one time 10,000 wheels.

Frenier, J. R. Little, the Bettendorfs, Howell, McDowell, Mast, and others are pioneers in the metal wheel industry, which has reached mammoth proportions. It has thus quickly reached mammoth proportions because of the application of special machinery, and the interchangeable system of manufacture.

Every process has its machine, and the amount of ingenuity exhibited in these machines the celerity with which they work, and the perfection of their product, are admirable. They illustrate in a very striking manner the advancement which has been recently made in the blacksmithing

business, for the time is not remote when these operations would have been performed by hand. I propose to describe some of the details of the manufacture.

In the cheaper kinds of metal wheels the rim of the wheel takes the places of both the tire and the felloes of the wooden wheel, and must therefore be large and strong enough to supply their places.

Commencing with the tire which is flat, half oval, half diamond, or whatever shaped cross-section is desirable, the first operation is to cut the dimension bars to the exact length, for dimension stock does not uniformly come accurately measured. The tire, after cutting to length, whether it is iron or steel, is perforated for the spokes by punching on a press which is long enough to punch the tire for a five-foot wheel at two strokes, making six holes at each stroke, or more, if there are more than twelve spokes to the wheel.

A yielding side pressure, which is, however, sufficiently strong to keep the bar firmly against the back gauges at each punch, insures the correct distance from the back edge of the bar to the center of each hole, whether the bar is wide or narrow, straight or crooked. The die hole is enough larger than the punch to make the die side of the hole the largest. When the bar is bent to the required circle of the wheel, it is turned so that the die side of the hole will be to the outside of the circle, as this, with the slight elongation consequent upon bending, enlarges the hole on the side where it is an advantage in riveting in the spokes.

The rolls employed for bending the tire are driven by a belt; their normal tendency is to keep agoing, but in case it is desirable, they can be stopped by pressure upon a treadle. They are open at one end, and the rolled tire can be readily removed without stopping, and so, barring accidents, the process of rolling is uninterrupted. When the tire has been rolled it is ready for putting on to the spider which is formed by the union of the spoke with the hub.

In the wheel whose manufacture is the subject of this description, the hub is made of malleable iron, and the spoke after being inserted in it is fastened there by having a shoulder formed on the outside of the hub, and by having the end riveted down on the inside in a recess formed in the casting for that purpose. The spokes are made either from iron or steel stock which is large enough to make the thickest part of the body. On some of the many varieties of wheels which are made by the same general processes, the spokes are oval in cross-section for about a third of the length, changing into round as they taper towards the point. The work of drawing them out into the desired shape is done by passing them through different grooves in segmental rolls. It is very expeditiously performed, and practical uniformity in size and shape is secured in them. After they are thus drawn, they are cut to a certain length, for although they have been worked under as nearly uniform conditions as practicable, and are made from the same sized stock, heated in the same fire, and passed through the same rolls, yet when the test of increase in length is applied, it is found that there is a great variation, and to restore them to uniform conditions, which is the essential principle of interchangeable work, it is necessary to re-cut them to equal lengths. They are now heated on the small end and submitted to the action of a ram, which staves up a collar on them at such a distance from the end as to leave the tenon outside of the collar of the right length to go through the tire and rivet on the outside.

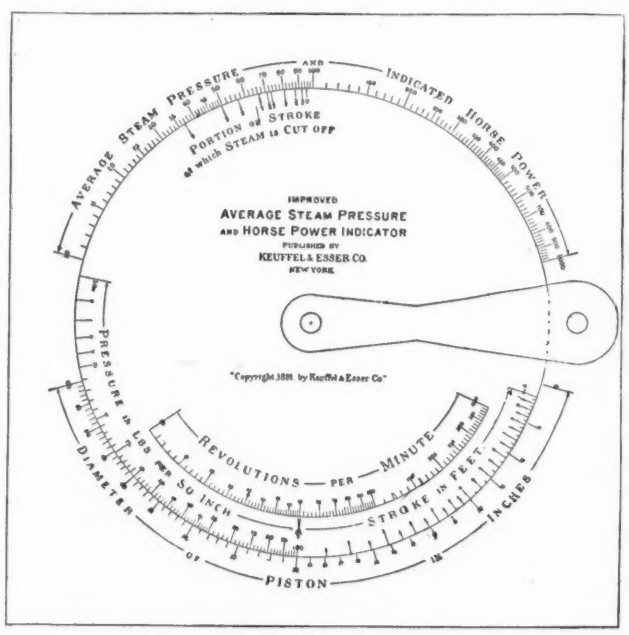
The American Machinist some time since called attention to some observations made by Charles A. Bauer, M. E., in Germany. He noticed there in one place some men making some pieces by a drop forging process at the rate of twelve in a minute, while in his establishment one man with a machine made 112 in the same period of time. If I comprehend the description, these pieces were driven into a hole in solid metal. Now any one who has tried to take out a piece from a hole into which it has been strongly stove will concede that the German workmen were doing as well as any one could do who used the same method. Even take the blank holder of a rivet-making machine, after the rivet has been headed, and before it has been ejected, and try to get the rivet out by hand, and it will be found to stick almost as tight as though it had been welded in. Light blows to drive it out only make it tighter, and yet how smoothly the machine works, the rivet seems almost to pop out of itself when the proper application of pressure is made. Any one who has undertaken to do similar work by hand, and remembers how it stuck in the die, is naturally surprised to see with what ease a collar is swelled out at a distance from the end of a rod. He would naturally think that when the plunger went back it would pull the imprisoned end of the stock back with it, tearing it off from the bar at the collar, but except in red short iron or steel this accident never occurs, and the ends of the spokes are left of a uniform length and size.

Having drilled whatever spoke holes were necessary in the hub, and the spokes being ready, the hub is placed in a special machine and held in a certain fixed position therein. In this position there is a mandrel in the axle hole of the hub which is as much less in size than the hole as the length of stock to be upset for riveting inside of the hole. For instance, if the hole is $1\frac{1}{4}$" and there is $\frac{3}{8}$" to be upset, the mandrel must be a little more than $\frac{3}{8}$" less than that, say "scant" $\frac{3}{4}$". The chamber inside the hub is deep enough to permit the riveted ends to be driven back beyond a line where they would come in contact with the axle or box.

The spoke is now placed red hot in a vise which is fixed at a certain distance from the hub, and in this vise it is gripped so tightly that it cannot slip. Now when motion is communicated to the machine by pressing a treadle, the mandrel moves in the hub against the end of the spoke, and at the same time the hub moves with half the speed towards the vise. The consequence of these two movements is that a collar is raised on the outside of the hub between it and the vise, and a riveted head is made on the inside, so that the spoke is firmly fastened outside and inside of the hub, and can go neither out nor in. The operation is performed very quickly, as all the motions are automatic, the attendant having simply to place the material in proper position and press the treadle.

Having made ready a number of tires all alike, and also a number of spiders all alike, the conditions exist for joining them together by inserting the ends of the spokes into the tire by machinery; but it has not yet been thought advisable to adapt machinery to this purpose, but a workman now takes a tire from one pile and a spider from another, and puts in only two or three of the spokes, and hands it to the operator of another special machine. It will be remembered that the spoke has a collar a certain distance from the end; this collar comes up against the inside of the tire, and the spoke is inserted in the vise of a riveting machine up to the collar, and then the machine being put in motion the end of the spoke is quickly riveted down, as with the pene of a hammer, into and around the hole through the tire. It is necessary theoretically and practically that it should be riveted into the hole, for otherwise when the outside riveting had worn off there would be none of the spoke support necessary to a suspension wheel. The riveting is done very rapidly without heating the spokes for the operation. The spokes easily fall into their places in the tire, as one after another is riveted, for the tire has not yet been welded, and before the interested spectator is aware of it they are all fastened into their places.

At this stage of the work the tire is in good shape to weld, as the spokes hold it steadily without giving it much chance to get out of the way. For the operation of welding, the furnaces used for heating use oil or gas as fuel, and are arranged as three branches on one upright stem, about which they may be revolved. The caps of these furnaces lift off by pressure upon a treadle. One of the caps being raised a wheel is placed in the opening, hanging on the furnace, so that the fire will heat the ends of the tire, and the cap closes over it to concentrate the heat. This furnace is now swung around out of the way, and another presents itself which is supplied with another wheel in the same manner, and the same operation is performed with the third. This brings the first one to the front, and the tire having come to a welding heat, the cap lifts and the wheel is taken out and put in position, with the ends of the tire which are to be welded laying in the lower die of a quick running upright power hammer. A few blows from this unites the two ends firmly together, giving the section operated upon the proper shape at the same time, and throwing out a little surplus stock in the shape of a fin at the sides. An assistant now takes the wheel, and after removing


Average Steam Pressure and Indicated Horse Power
Portion of Stroke at which Steam is Cut Off
Improved
Average Steam Pressure
and Horse Power Indicator
Published by
Keuffel & Esser Co.
New York
"Copyright 1891 by Keuffel & Esser Co."
Pressure in Lbs. per Sq. Inch
Revolutions — per — Minute
Stroke in Feet
Inches
Diameter of Piston

Steam Pressure and Horse-power Indicator.

the fins with a few strokes of the rasp, rolls it off to one side to cool off for the final operations of truing up, which are to be done with large horizontal machines which work somewhat on the principle of a universal lathe chuck, as all the clamping jaws move toward the center simultaneously, and compress the wheels all around at the same time and give them the right "dish."

Workmen complain that before the welding heats are *soft* enough clear through the outside wastes away, not in the form of scales from rapid oxidation, but by melting and running off. This is caused by the too great fierceness of the heat which melts off the surface before it is conducted back from particle to particle. Very serious difficulties are met with from this cause in welding the tire of planter wheels, which are $6'' \times \frac{1}{8}''$, and are most economically made of steel, to obtain the requisite stiffness in the thickness that must be used to reduce the weight and retain the width.

There have been some wheels made by welding with electricity, the use of which, it is said, enabled the operation to be successfully performed of welding the spokes to the hub. The addition of the wonderful agent electricity to the resources of the blacksmith's art is full of promise. This means of heating has the power of concentration, and it can be applied to one point and at one point, in so gradual a manner, as to "keep the heat a coming" until the temperature of the work is uniformly raised to the required degree. The development of its power in various branches of the trade is somewhat hindered by the too rigid adherence of manufacturers to the first line of the old motto:

"Be not the first by whom the new is tried,
Nor yet the last to lay the old aside."

Steam Pressure and Horse-power Indicator.

The accompanying illustration represents an improved average steam pressure and horse-power indicator. It works on the principle of a slide rule. With it the mean steam pressure for any cut-off in a cylinder of an engine can be readily obtained, and the indicated horse-power of a steam engine with any cut-off can be as easily found without any computation. We find it to be very reliable, and with its use much labor and time can be saved. The indicator is made of cardboard; the dial, on which the revolutions and steam pressures are marked, rotates on its center, and the arm swings on the same point. The mean steam pressure is found with one setting, thus: Set the zero of the cut off scale to the initial pressure of the steam on the outer and upper scale, and opposite the given cut-off will be found the mean pressure in pounds per square inch of piston. To obtain the indicated horse-power of an engine, more than one setting will be required; but the operation is very simple, thus: Set the stroke in feet to the diameter of the piston in inches; set the arm to the arrow; bring the pressure in pounds per square inch to the arm; set the arm again to arrow; bring the revolution per minute to the arm. Then find opposite the given cut-off the indicated horse-power.

This indicator was invented by Mr. Wm. Cox, who has made the slide rule a special study. It is published and supplied by Messrs. Keuffel & Esser Co., 127 Fulton street, New York.

Manufactures.

Clear Lake, S. D., is agitating the erection of a tow-mill.

The Bridgeport (Ala.) Pipe Works has commenced operations.

New machinery will be placed in the Hartsville (S. C.) Pulp Mill.

The electric light plant at Crawfordville, Ind., will be enlarged.

The Hazleton (Kan.) Roller-mill Company will enlarge its plant.

The erection of a barb-wire factory is talked of at Nebraska City, Neb.

Parties are seeking location for a reduction plant in Fredericksburg, Va.

Keely Bros., Goshen, Ind., will operate a machine shop in connection with their foundry.

The Virginia Manufacturing Company is reported as erecting machine shops at Suffolk, Va.

The Greenville (Tenn.) Electric Light Company will put in another dynamo, it is reported.

The Atlantic Coast Line (office, Wilmington) will erect machine shops at Rocky Mount, N. C.

The engine house at Kendall, Hadley & Co.'s plant, at Goffstown, N. H., is to be enlarged.

The Lisk Manufacturing Company has decided on the site for its new plant, at Canandaigua, N. Y.

There is a probability of the railroad shops being removed from Montgomery, Ala., to Castleberry.

Joseph Hall & Co., of Richmond, may possibly remove their iron works plant to Manchester, Va.

A $100,000 stock company is being organized at Fredericksburg, Va., to erect an electric light and power plant, etc.

The Yale & Towne Manufacturing Company, of Stamford, Conn., is building an addition to its bank lock department.

A Mr. Schuster, of Philadelphia, Pa., will erect, it is stated, a plant for the manufacture of sewer pipe in South Pittsburg, Tenn.

The American Foundry and Machine Company's plant at Bowling Green, Ohio, has been burned. The company will rebuild.

The Greenville (Tenn.) Electric Light Co. will build a new power house and put additional machinery in its electric light plant.

The Upper Appomattox Electric Light Company, Petersburg, W. Va., will, it is reported, put new machinery in its electric light plant.

A new company is reported as to be organized, for the erection of an electric light plant at Piedmont, Ala. The mayor can give information.

The Penn Hardware Company, of Reading, Pa., have just erected a new brass foundry 40x120 feet. It was put in operation on January 16.

The Phelps Manufacturing Company has been incorporated at San Francisco, Cal., with a capital of $300,000, to manufacture iron, steel, etc.

The Cardwell Machine Company, Richmond, Va., has purchased and will operate the plant of H. M. Smith & Co.. thus doubling its capacity.

A company with a capital stock of $50,000 has been formed at Beaver Falls, Pa., for manufacturing drawn steel under the Moltrop patents.

The Barnett Manufacturing Company, of New York, has been organized for manufacturing packing for steam engines, etc. Capital, $5,000.

E. L. Henning, Albert H. Sears and James L. Hatch have incorporated the Piano Steel Company, at Piano, Ill., with a capital stock of $50,000.

D. S. and R. J. McCullough, of Marshall County, and J. H. Neil have purchased and will operate the Southern Machine Works, at Shelbyville, Tenn.

Hartwell Bros., Clifton, Tenn., are reported as to put new machinery in and enlarge their handle factory; also as to put in an electric light plant.

It is said that a large manufacturer of Illinois contemplates purchasing a large tract of land in Kokomo, Ind., on which he will erect a large industrial plant.

The Commissioners' Court of Llano County, Tex., has instructed W. S. Maxwell to advertise for bids on the construction of an iron bridge across the Llano River.

The Clinton Bridge and Iron Works, of Clinton, Iowa, has been formed, for the construction and repair of bridges, manufacturing machinery, etc. The capital stock is placed at $50,000.

The Horton Iron Company has been organized at Duluth, Minn., with a capital stock of $500,000. The incorporators are: R. H. Harris, R. P. Edson, H. B. Moore and W. G. Horton, of Mayville, N. D.

C. W. Borcherding, A. C. Pierson, S. P. Grey and others have incorporated the Clay working Machinery Co. at Chattanooga, Tenn., to manufacture clay working machinery. The capital stock is $10,000.

The Steel Cable Engineering Company, capital stock $100,000, has been organized at Portland, Me., for the purpose of carrying on general foundry work. The president is Walter W. Rogers, of Chelsea, Mass.

The Kinsman Block System Company, of Plainfield, N. J., has been organized, with $2,000,000 capital stock. The incorporators are: F. E. Kinsman and E. C. Perkins of Plainfield, N. J.; W. C. Fisk, of Wilburtha, N. J., and others.

It is the intention of the Egan Company, of Cincinnati, to make a very complete exhibit of their improved wood-working machinery at Chicago, and they have, with that object in view, applied for 20,000 square feet of floor space.

The California Iron, Steel and Tin Plate Company has been organized, to operate in New Mexico and California The incorporators are T. R Gable, C. S. Hubbs and James Anthony, of Albrig, New Mexico. Capital stock, $5,000,000.

The Lunkenheimer Brass Manufacturing Company's calender for '92 has on it a working model of one of their gate valves, made out of paper, embossed. It is quite a mechanical calender, and can be obtained of the company at Cincinnati.

The directors of the Deane Steam Pump Company, Holyoke, Mass., chosen at the recent annual meeting, are as follows: Theophilus Parsons, president; C. H. Heywood, treasurer; Charles P. Deane, Stephen Holman, Emerson Gaylord, George W. Prentiss, Philander Moore.

The Sioux City (Iowa) Engine Works has elected as directors: C. M. Giddings, E. H. Bucknam, E. L Matthews, C. B. Oldfield and G. Y. Bonus. New stock to the amount of $30,000 has been subscribed, and it is proposed to increase the business materially during the coming year.

The Maxon Detachable Steel Chain Belting Company has been incorporated at Dayton, Ohio, for the purpose of manufacturing and selling chains, link belting, and link belting machinery, etc.; incorporators: Thos. Maxon, Thos. Staniland, Jos. A. Worthman and others; capital, $50,000.

We have received the new catalogue of the Detrick & Harvey Machine Co., Baltimore, Md. It is devoted to illustrations and descriptions of their "open side" planer, which is an unique tool, proving very useful in many cases. A shaper of somewhat novel construction is also illustrated.

There is water-works agitation in Middletown, Pa.; Butte, Mont.; Phillipsburg, Mont; Crestline, Ohio; Lincoln, Neb.; Linndale, Ohio; Beverly, Va.; Weston, Ohio; New Orleans, La.; Arkville, N. Y.; Bliss, N. Y.; Lockport, N. Y.; Sherburne, N. Y.; Bradford, Pa.; Greenfield, Ind.; Maywood, Ill.

Pawling & Harnischfeger, of Milwaukee, Wis., send a catalogue describing and illustrating a line of special machine tools built by them, including pit and other large lathes, grinding machines for truck wheels, etc. All the tools are special in their nature, and are usually built or modified to suit some particular condition.

We are informed that Messrs. Hill, Clarke & Co., of Boston, have purchased the business of A. J. Kirkwood & Co., 12 South Canal street, Chicago, together with the stock of machinery, lease of the building, good will, etc. On April 1st Mr. C. A. Clarke will go to Chicago to reside, and will have charge of the business, which will then be the Chicago branch of Hill, Clarke & Co.

We have received the new illustrated catalogue of the Hendey Machine Company, Torrington, Conn. It contains many illustrations and descriptions of improved machine tools, most of which have been illustrated and described in our columns. It contains also a complete telegraph cipher code for correspondence with the company, and will be found convenient to have at hand.

A company has been formed at Wheeling, W. Va., with a paid-up capital of $100,000, to manufacture and introduce a machine for making cut nails with screw points. The machine is the invention of M. Altmyer, of Oakland, Cal., formerly of Wheeling. It is claimed that the machine makes the best nail yet designed, at a rate of about 14 in the time formerly consumed by the quickest process in making one.

The Taylor Bros. Iron Works, Limited, New Orleans, La., has purchased the sugar mill and engine patterns, stock, etc., of the Niles Sugar Mill Works and the Blymyer Manufacturing Company, both of Cincinnati, Ohio. The Taylor Bros. Company will at once erect a plant suitable for the manufacture of the Niles mills and the Blymyer engines. It will consist of a modern molding room, 120x55 feet, machine shop 100x100 feet, and store-room 75x100 feet.

Waterford, N. Y., will soon lose the Button Fire Engine Works, the company having joined the American Fire Engine Company, with headquarters at Seneca Falls, N. Y., and Cincinnati, Ohio. The entire machinery of the Button Works will be removed to Seneca Falls, where the Button, Clapp & Jones and Silsby engines will be made. A number of the employes at the Waterford shops have been dispensed with, but all are given the preference of positions at Seneca Falls.

Mr. F. E. Reed, the well-known Worcester manufacturer of machine tools, has purchased of Col. Samuel E. Winslow his interest in the Winslow & Curtis Machine Screw Company. This makes about four of Worcester's important industries that Mr. Reed is now interested in, and we are glad to be able to say that he merits his success, his shops being exceptionally well arranged and managed, and his relations with his employes of the most pleasant and satisfactory nature.

The Hill Sprinkler Company, of Columbus, Ga., has united with the Neracher Sprinkler Company, of Warren, Ohio, and also purchased all the tools and patents of the Clapp Sprinkler Company, of Chicago, Ill. A new company has been formed and incorporated under the laws of Georgia, known as the Neracher & Hill Sprinkler Company, with principal office and works at Columbus, Ga., and branch works at Warren, Ohio. The capital stock fully paid up is $400,000.

The D. Van Nostrand Co., 23 Murray and 27 Warren streets, New York, has issued a new catalogue of technical and scientific books, which is so classified as to make it very convenient for reference. For instance, all books relating to locomotive practice are listed by themselves and classified alphabetically by authors, and the same plan is carried out all through the catalogue. It is brought fully up to date and is very complete. It should be in the hands of every one who is interested in knowing what the literature of any technical subject is.

The True Blue Marble Company, of Rutland, Vt., will replace the mill, lately destroyed by fire, with an iron building, and have placed the contract with The Berlin Iron Bridge Company, of East Berlin, Conn. The building will be composed entirely of iron and marble, and will be 80 feet in width by 254 feet in length, the side walls being of iron and marble, and the roof of corrugated iron. Not only the entire building will be of iron, but the frame work inside for carrying the gang saws, shafting, etc., will be of iron, so that there will be no woodwork about the building to take fire.

Machinists' Supplies and Iron.

NEW YORK, February 27, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $16.50 to $17.50; No. 2, $15.25 to $16.50; Grey Forge, $14 to $14.50. Southern brands of good quality are obtainable at $15.75 to $17 for No. 1 Foundry; $15 to $16 for No. 2; and $13.50 to $14 for Grey Forge.

Scotch Pig—Coltness is quoted at $21.50; and $20.25 for Eglington.

Antimony—The demand for spot continues good, and stocks are light.

We quote Hallett's, 10¾c.; Cookson's, 14¾c. to 15c.; and L. X., 12c. to 12½c.

Copper—Lake copper is dull and featureless. Bids are solicited at 10.50c. to 10.55c. on spot, but orders are scarce. Casting copper is irregular at 10.25c. to 10.50c.

Lead—There is a firm feeling, but it is not supported by the demand. There are buyers at 4.15c. to 4.20c., according to quantity, but supplies are held at 4.25c.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c.

Spelter—Smelters decline 4.50c., and buyers limit their bids as usual to 4.50c. for New York delivery.

Tin—The market is in sympathy with foreign advices. Small sales are reported at 19.60c. Speculative interest is stagnant.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

An ordinary boss machinist without any fringes wants a job. Address Box 62, AM. MACHINIST.

Wanted—Position by mechanical draftsman; New York or B'klyn; references. F. D., AM. MACHINIST.

Wanted—Two good molders for steam and hot water heater work; none but steady men need apply. Address XX, care AMERICAN MACHINIST.

An A1 machinist wants a position; used to close, accurate work, and an experienced tool maker, intelligent, steady and reliable. F. W., AM. MACH.

Wanted—Mechanical draftsman for detail work chance for advancement if competent. Address BOX 58, AMERICAN MACHINIST.

Molder wanted to take charge of foundry; must understand core work and mixing of iron and brass. Apply to La France Fire Engine Co., Elmira, N. Y.

Wanted—Position as superintendent of machine shop, or salesman, by tech. graduate; 15 years' exp. as mach., draftsman & salesman. Box 64, AM. MACH.

Situation wanted by a first-class machinist, experienced in special machinery, jigs and tools; at present foreman in electric shop, but would like to change. Address Foreman, AMERICAN MACHINIST.

Wanted—25 first-class machinists accustomed to Corliss and automatic engine work; steady work and good wages to the right men. Apply to Sioux City Engine Works, Sioux City, Iowa.

A first-class man, having ten years' experience in the manufacture of steam engines on a large scale, on the interchangeable plan and jig system, desires a position as superintendent. Address A. B., care AMERICAN MACHINIST.

A progressive, wide-awake mechanic wants engagement. "Hard headed" knowledge of machine shop, pattern shop, drafting room details; competent manager, good designer, addicted to close application to business; O. K. refs. Box 56, AM. MACH.

Wanted—At once, a good general or all-around machinist for jobbing shop, who can go out to do work when necessary; fair wages; give reference. Address Box 61, AMERICAN MACHINIST.

Situation wanted, by a technical graduate of 29; has successfully held positions as foreman machinist, chief draftsman, and superintendent of a general machine works; competent to conduct duty trials of steam plants, design and erect general machinery. H. L., care AMERICAN MACHINIST.

Wanted—A young man to travel in New York City and the surrounding country for a local house. One thoroughly familiar with the engine, boiler and heavy machinery line. No others need apply. Address, stating all particulars and salary expected, P. O. Box 3272, New York City.

We desire to engage the services of a first-class young man to take charge of the erecting rooms of our Blower and Engine Dep't. In addition to being a mechanic must be able to handle men (50 to 75), and possess that rare qual'n, "executive ability." He will not be hampered, being responsible only to gen. manager. Buffalo Forge Co., Buffalo, N. Y.

Wanted—A foreman molder, for a growing shop out of town, now employing about six molders. Must be capable of turning out good, smooth castings, and have men do a fair day's work. No unions or walking delegates to bother. A good position to the right man. Address, stating wages wanted (to start with), Box 63, AMERICAN MACHINIST.

A practical and educated mechanical engineer who has successfully filled responsible positions in manufacturing concerns, is open for engagement; good executive; well up in modern practice and labor-saving devices, and also in economical production of duplicate and interchangeable parts; can take charge of the erection of a plant from ground up, including equipment. Progressive, AM. MACH.

Bradley Hammers

REPUTATION.
Men test everything in this world by what it produces.
2000 IN USE
BRADLEY & COMPANY, SYRACUSE, N. Y.
BRANCHES IN NEW YORK AND BOSTON.

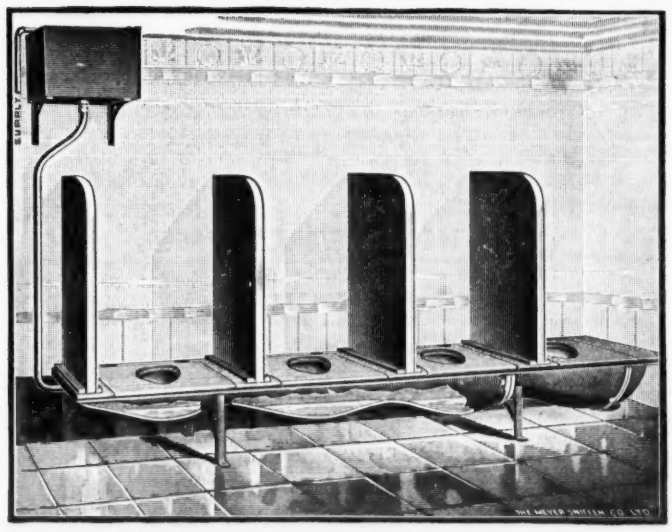
STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

POPULAR AND INSTRUCTIVE BOOKS
FOR ENGINEERS AND FIREMEN,
By STEPHEN ROPER, Engineer.
Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them.
Descriptive Catalogue Mailed Free.
EDWARD MEEKS, Publisher,
No. 1012 Walnut St., PHILADELPHIA, PA.

ELEMENTARY MECHANICS
By PHILIP MAGNUS,
14th edition, 12mo, cloth, $1.25.
JOHN WILEY & SONS,
NEW YORK.

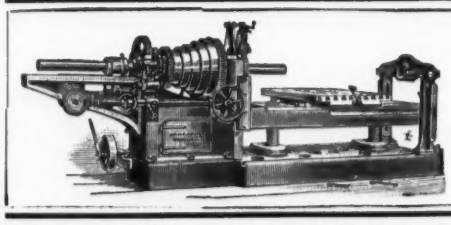
BRASS AND BRONZE CASTINGS
A SPECIALTY.
By a molder of 50 years experience. Castings guaranteed true to pattern. Get my prices.
GEORGE HIBSCH, 4 1-2 Plain St., Albany, N. Y

A PROPERLY CONDUCTED MANUFACTURING ESTABLISHMENT



Should provide its employees with decent Water Closet accommodations. This contemplates a simple apparatus easily kept clean and not liable to get out of order. These conditions are best met by the
EM-ESS PARSONS SCHOOL WATER CLOSET, successfully used in Schools, Factories, etc., for several years past. The arrangement of each basin in the section at a slightly lower level, with its weir or dam toward the outlet, is novel and important, securing an equal flush to each, with a minimum quantity of water — an important consideration when meter rates have to be paid. The flush is automatic at desired intervals.

For Illustrated Circular, Price List, etc., address
THE MEYER SNIFFEN CO., Ltd.
Manufacturers of
Sanitary Specialties and Superior Water Work.
46 & 48 CLIFF STREET, NEW YORK.



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WILMINGTON, DEL.
MACHINE TOOL BUILDERS.
IMPROVED PATTERNS! LATE DESIGNS!

H. W. JOHNS'

ASBESTOS SECTIONAL PIPE COVERINGS.
Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY. CHICAGO. PHILADELPHIA, BOSTON, ATLANTA, LONDON.

I wish to correspond with parties who may be in need of a competent man in charge of mechanical department of works, or as head draftsman. Have had long and good experience in the manufacture of machine tools, engines, general machinery, and in railroad work. Am a thorough and progressive mechanic, and my record will bear investigating. Age, 32. Address H., care C. H. Cochrane, Room 119, Bible House, N. Y.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Best Portable Forge, $12. Am. Tool Wks., Clev., O.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Agent wanted in every shop. Money in it. Scientific Machinist, Cleveland, O. Sample copies free.

For Sale—Patent 465,676. High Duty Attachment for Steam Pumps; 100,000,000 Duty. H.D., AM. MACH.

Cheap—Two H. P. Engine Blue Prints complete. Designed to be built on an ordinary lathe. W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

Wanted to Buy—Second-hand Boring Mill, Planers, Lathe, Shapers, Drill Press, Gear Cutting Machine. W. S. Ammon, 216 and 218 Court Street, Reading, Pa.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 96 Fulton street, New York.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa

Business Opportunity—A practical boiler maker, with some capital, who understands all kinds of iron work, including machine work (except marine) wishes to correspond with parties wanting partners in new or established business; has had 23 years' experience; 15 years of that time as superintendent. Best of references given. Address Boiler Maker, P. O. Box 672, New York City.

Machine Tools in Stock.

ENGINE LATHES.

78 in. swing,	9 ft.	between centers		Sellers
38 do	17 ft.	bed.	New	Fifield
30 do	14	do	do	do
28 do	12	do	do	
27 do	16	do	do	
24 do	12	do	do	Fifield
24 do	12	do	do	Fitchburg
24 do	12	do	do	Flather
22 do	10	do	New Pattern	Fifield
22 do	12	do	do	do
22 do	12	do	New	Blaisdell
22 do	8	do	do	Flather
22 do	10	do	do	do
20 do	8	do	do	do
20 do	10	do	do	do
18 do	8	do	do	do
18 do	10	do	do	do
18 do	8	do	do	Blaisdell
18 do	10	do	do	do
16 do	6	do	do	Flather
16 do	6	do	do	Blaisdell
15 do	6	do	do	Flather
14 do	6	do	do	do
14 do	6	do	do	Blaisdell
12 do	6	do	do	do

PLANERS.

42 in. wide,	42 in.	high,	12 ft. long, 2 heads	Gleason
36 do	36	do	8 do	Pease
30 do	30	do	8 do	do
30 do	30	do	8 do	Whitcomb
30 do	30	do	8 do	Flather
26 do	26	do	6 do	do
24 do	24	do	6 do	do
24 do	24	do	6 do	Whitcomb
22 do	22	do	5 do	do
22 do	22	do	6 do	Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
15 and 24 inch stroke	Hendey
32 inch stroke with key-seating attach.	Walcott

UPRIGHT DRILLS.

20, 21, 25, 28, 30 and 36 inch swing	Prentice
20, 23, 25, 28 and 34 inch swing	Blaisdell
60 inch swing Radial Drill	Baush

HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

New and Second-Hand Machinery.

ENGINE LATHES:—15 in.x 6 ft.; 16 in.x6 ft.; 18in.x 6 ft.; 18 in.x7 ft.; 18 in.x8 ft.; 20 in.x7½ ft.; 20 in.x8 ft.; 21 in.x8 ft.; 21 in.x10 ft.; 24 in.x20 ft.; 28 in.x 12 ft.; 28 in.x16 ft.; 32 in.x14 ft.; 32 in.x16 ft.; 3.in.x18 ft.; 33 in.x12 ft.; 50 in.x22 ft.; 72 in.x17 ft.; 84 in.x 16 ft.

PULLEY LATHES: 8 ft.x60 inch.

IRON PLANERS:—24 in.x24 in.x4 ft.; 26 in.x26 in.x6 ft.; 24 in.x24 in.x6 ft.; 26 in.x24 in.x5 ft.; 28 in.x28 in.x8 ft.; 30 in.x30 in.x7 ft.; 30 in.x30 in.x8 ft.; 32 in.x32 in.x10 ft.; 36 in.x36 in.x10 ft.; 54 in.x42 in.x24½ ft., two heads; 62 in.x42 in.x16 ft.

UPRIGHT DRILLS:—20 in. swing, 26 in. swing, 30 in. swing.

SHAPING MACHINES:—9 in stroke, 11 in. stroke, 12 in. stroke, 16 in. stroke, 15 in., Hendey.

SLOTTING MACHINES:—9 in. stroke.
1 No. 3 Brainard Milling Machine, back geared.
1 No. 3 Union Vise Co. Milling Machine, back geared.
1 Heavy Index Milling Machine.
1 Large Horizontal Boring Machine.
1 Boring Machine 30 in. between Uprights.
2 Bolt Cutting Machines to cut to 1 1-4 in.
1 Bolt Cutting Machine to cut to 1 1-2 in.
2 Stay Bolt Cutting Machines.

UPRIGHT ENGINES:—6 in.x7 in.; 7 in.x7 in.

BRADLEY HAMMERS:—60 and 100 lbs.

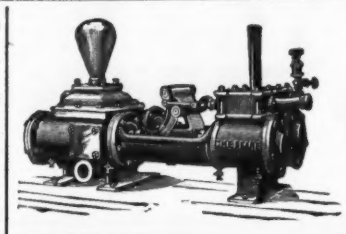
HORIZONTAL ENGINES:—6 in.x9 in., Rice Automatic; 6 in.x10 in.; 11 in.x18 in. Slide Valve. 14 in. x30 in., CORLISS.

GEO. PLACE MACHINE CO.,
120 Broadway, New York.

JESSOP'S STEEL

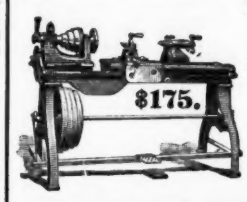
FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

MAKERS OF
The FINEST STEEL
CRESCENT STEEL CO.
PITTSBURGH. CHICAGO. NEW YORK.
NOW USED FOR TOOLS, DIES, MILLING CUTTERS, &C.



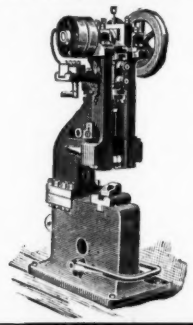
Improved Screw Cutting Foot and Power.
LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

FINE TAPS, DIES, REAMERS, ETC.,
LIGHTNING AND GREEN RIVER SCREW PLATES.

NEW GREEN RIVER TAP WRENCH.
Tap Wrenches, Bolt Cutters, Hand and Power Drilling Machines, Punching Presses and Other Labor-Saving Tools.
WILEY & RUSSELL MFG. CO., Greenfield, Mass. SEND FOR NEW CATALOGUE.

A LONG FELT WANT SUPPLIED.



A Power Hammer that is Controllable, Efficient and Durable.

TAKES THE MINIMUM OF POWER AND GIVES THE MAXIMUM OF EFFICIENCY.

The operator can control perfectly the force of the first or any succeeding blow and stop the hammer instantly.

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THE HACKNEY HAMMER CO.
Johnson Street, - CLEVELAND, OHIO

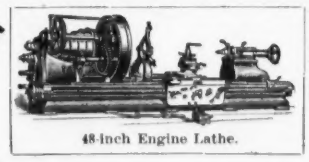
SENSITIVE BENCH DRILL PRESS No. 1.
This is the same as our No. 2, except it is smaller.
Drill capacity from 0 to 3-16.
MILLIKEN & D'AMOUR,
151 and 153 Cedar Street, New York City.
FINE MACHINE WORK TO ORDER.

R. MUSHET'S SPECIAL and TITANIC STEELS.

How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.

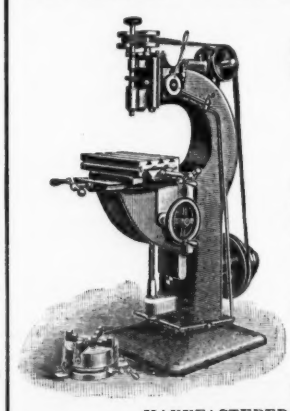
B. M. JONES & CO.,
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.
143 Liberty St., NEW YORK.

FITCHBURG MACHINE WORKS,
MANUFACTURERS OF THE CELEBRATED
FITCHBURG MODERN ENGINE LATHE
AND OTHER METAL-WORKING MACHINES


48-inch Engine Lathe.

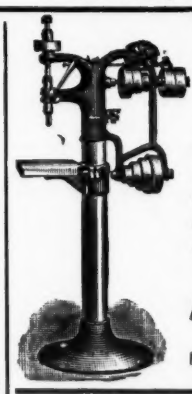
SEND FOR CATALOGUE E.
FITCHBURG, MASS.

THE BECKER VERTICAL MILLER



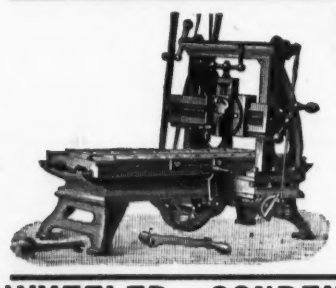
No. 2.
For High Speed Milling.
An indispensable Tool in any well appointed machine shop.
Speeds from 240 to 10,000 revs.
Send for Circular.
MANUFACTURED BY
JOHN BECKER MANF'G CO.,
Water St., Fitchburg, Mass.

THE NORTON DRILLS.
FOR LIGHT, SENSITIVE AND RAPID DRILLING.



1, 2, 3, 4 or more Spindles, Sensitive or Automatic Feed
To drill from 0 to 1-2 inch holes.
The *Latest* and *Best*; most convenient, sensitive and durable Drill on the market.
Have Balanced Spindles and Balanced Tables.
Write for prices and description, or for Special Machinery.

THE NORTON & JONES
Machine Tool Works,
PLAINVILLE, CONN.
Manufacturers of Machine Tools and Special Machinery.



SMALL POWER OR HAND PLANER.
FOR ANY SMALL WORK.
Weight of Platen 100 lbs.
A. J. WILKINSON & CO.,
184 Washington St., BOSTON, MASS.
SEND FOR CIRCULAR.

FOR SALE OR LICENSE

The United States Patent of a mechanical invention, returning good profits, in England (books produced). List prices from £25 up to very large amounts, and principally large castings, with very little machine work below. Address S.,
The International News Co.,
Breams Buildings, Chancery Lane,
London, England.

FOOT and POWER LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws, Machinists' Tools and Supplies. Lathes on trial. Catalogues mailed on application.
SEBASTIAN LATHE CO. 43 & 45 Central Avenue, CINCINNATI, O.

WHEELER CONDENSER AND ENGINEERING CO.
92 & 94 Liberty Street, New York.
MANUFACTURERS OF IMPROVED
SURFACE CONDENSERS.
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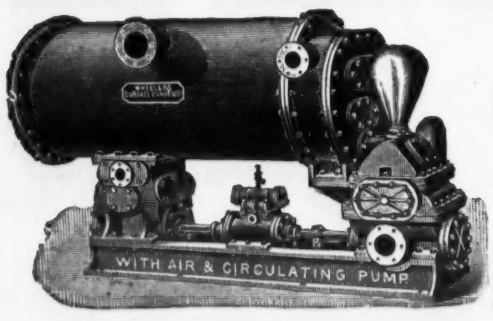

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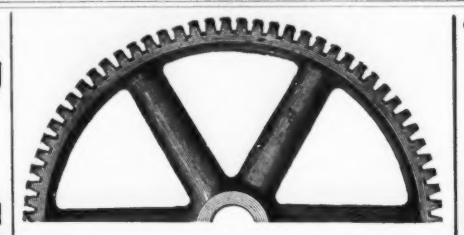

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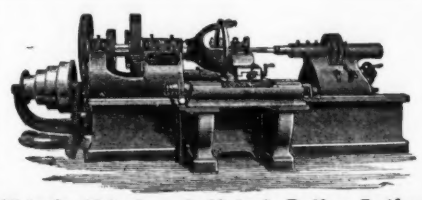

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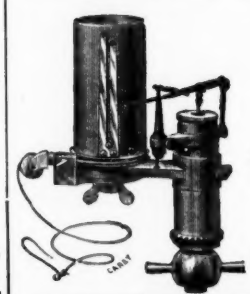

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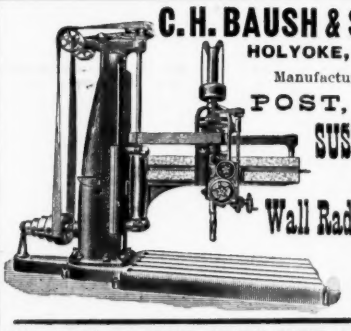

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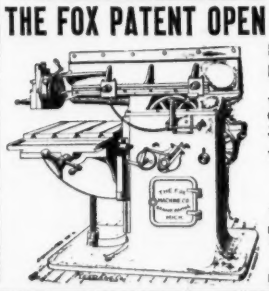

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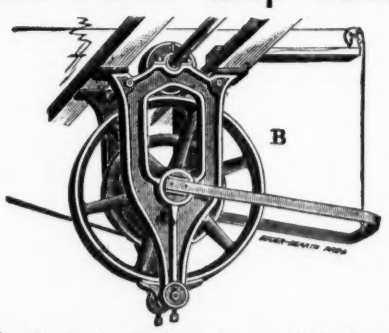

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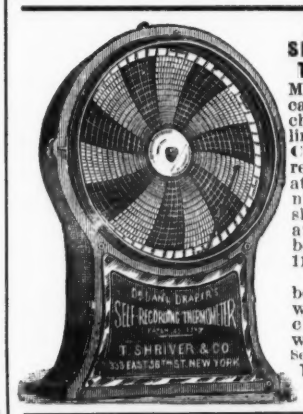

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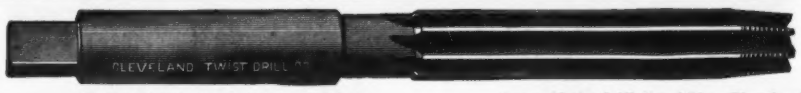

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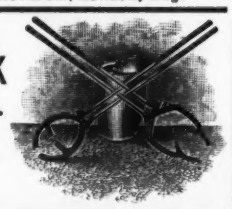

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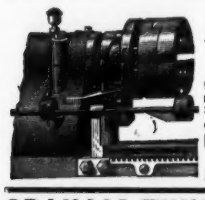

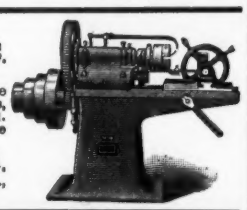

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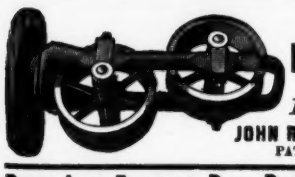

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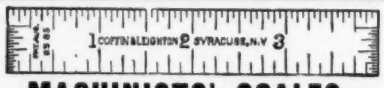

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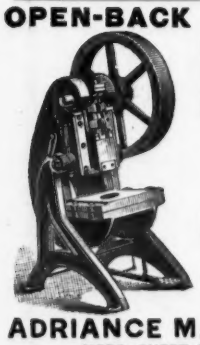

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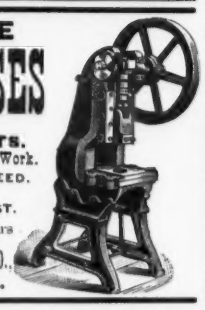

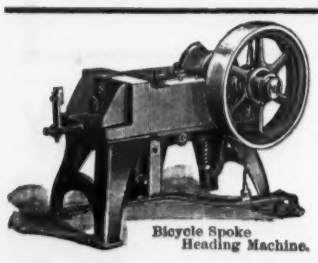

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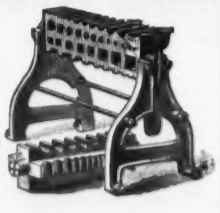

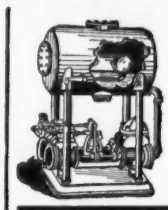

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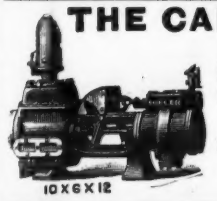

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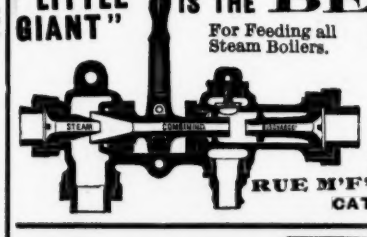

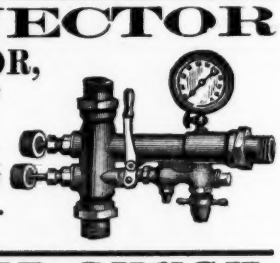

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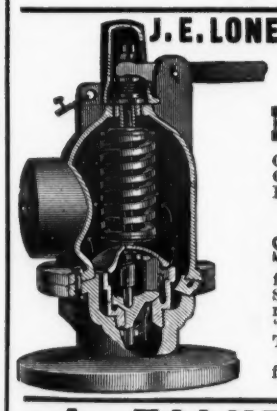

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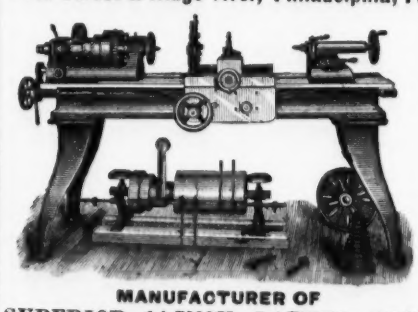

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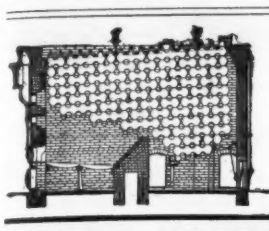

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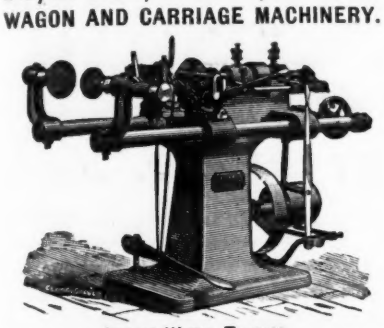

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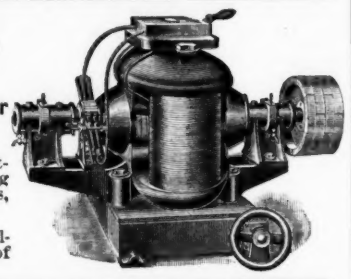

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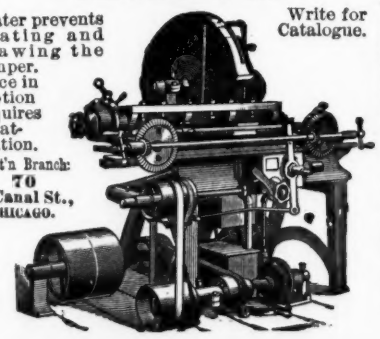

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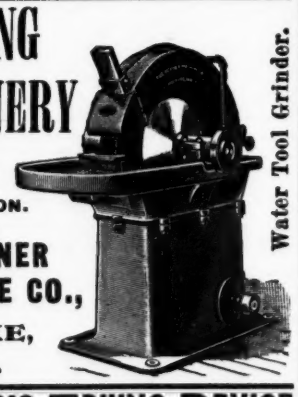

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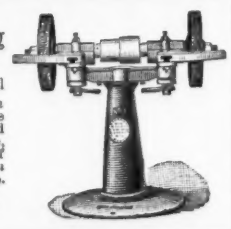

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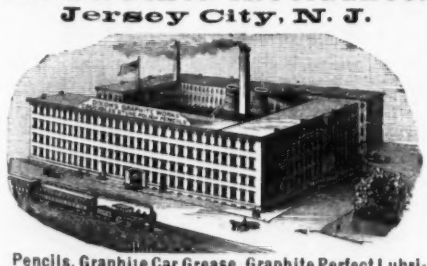

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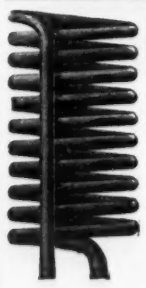

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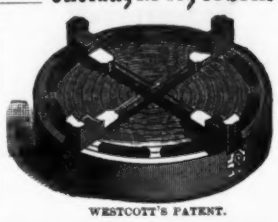

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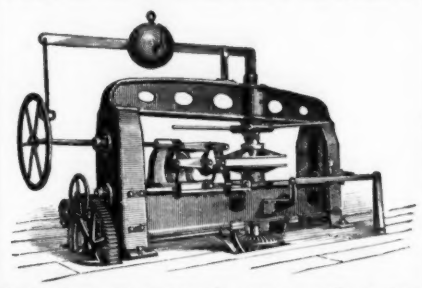

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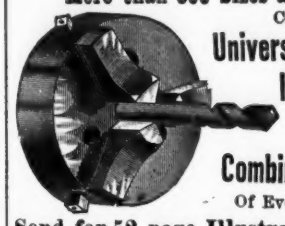

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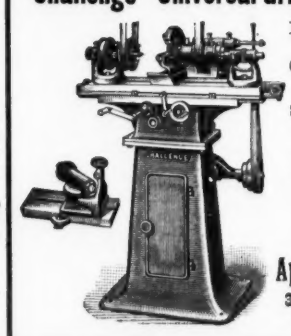

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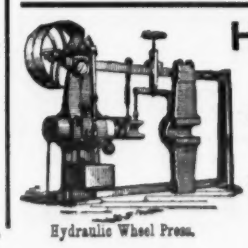

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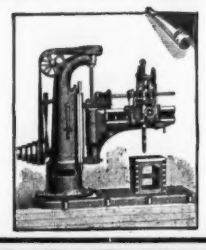

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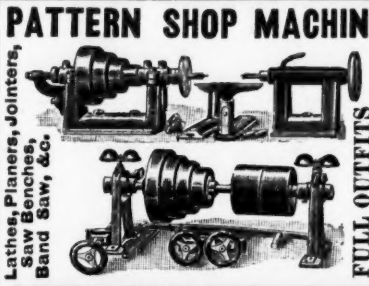

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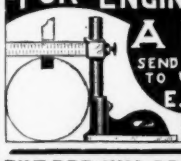

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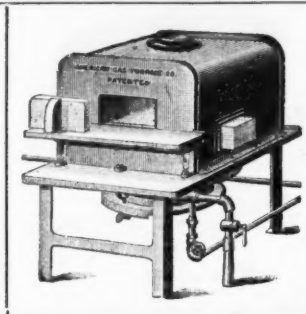

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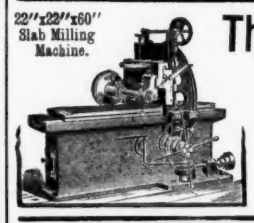

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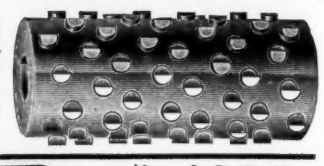

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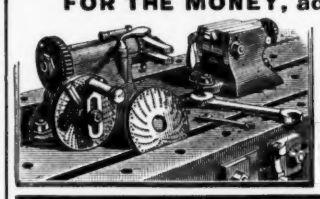

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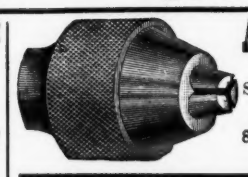

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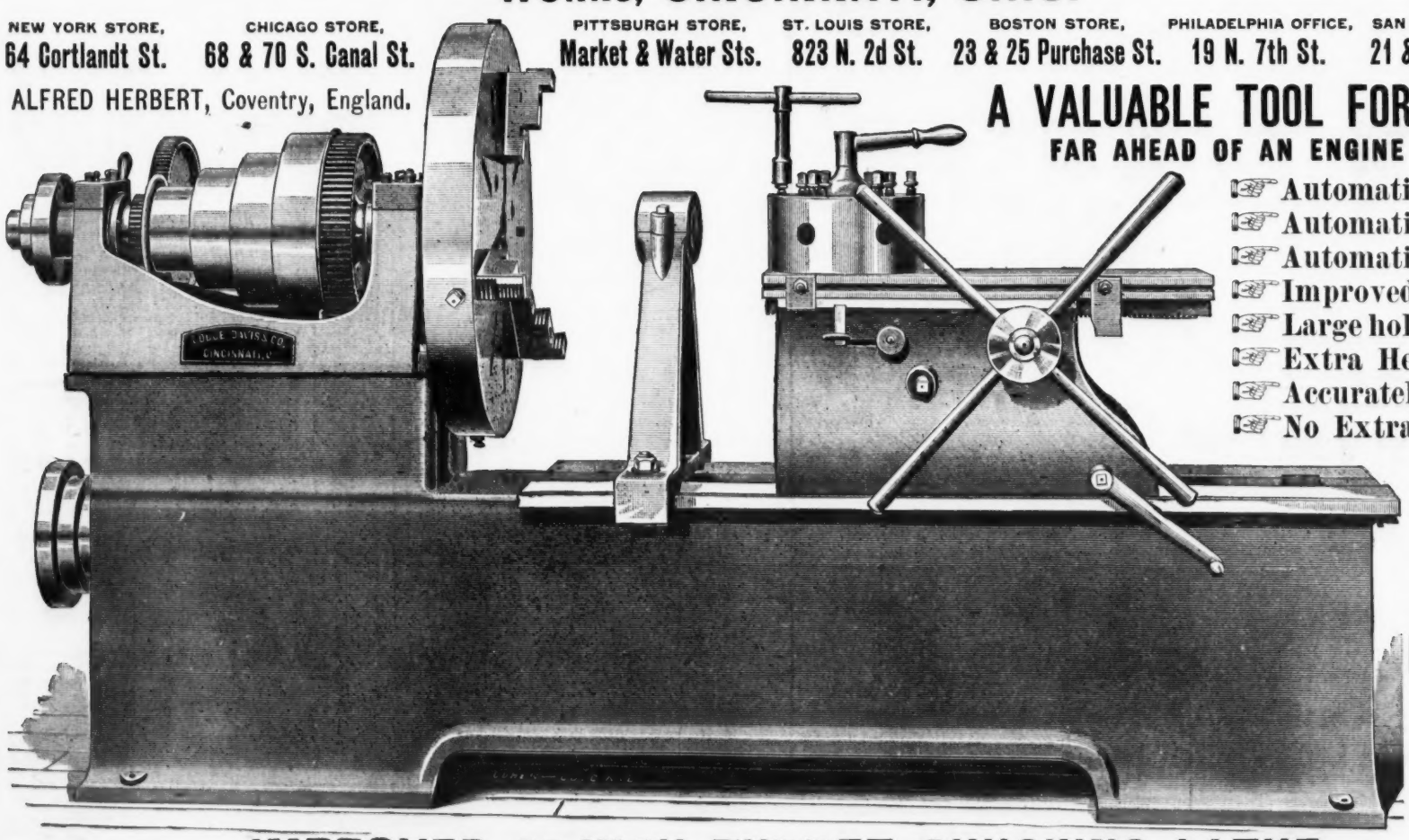

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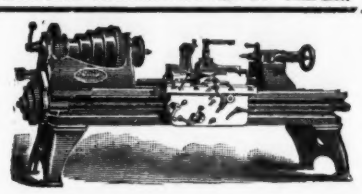

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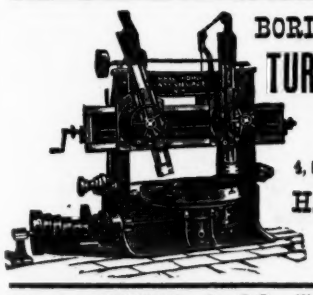

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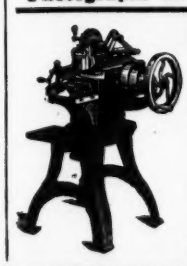

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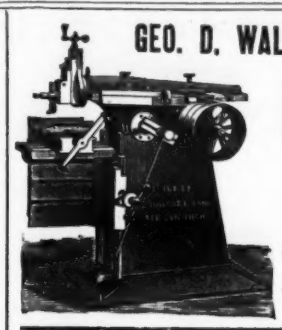

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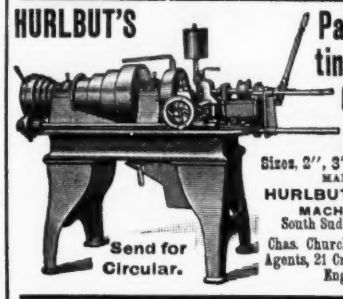

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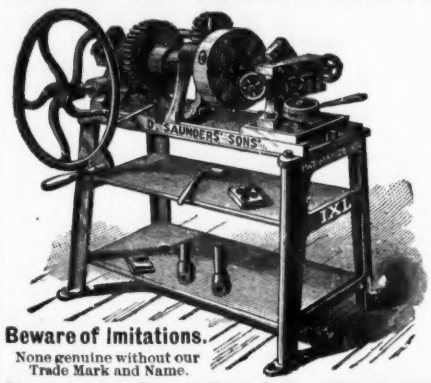

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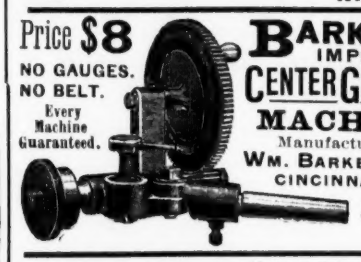

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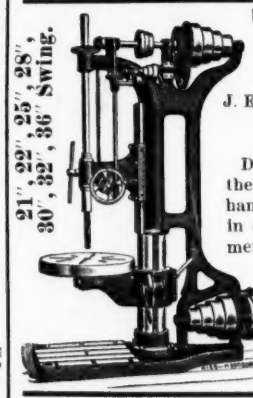

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Yours very truly,
JOHN KRUESI,
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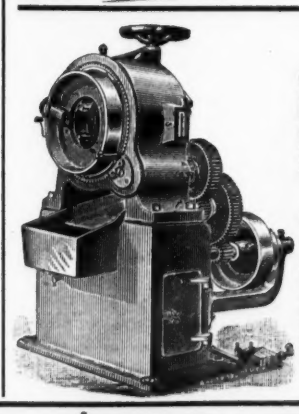

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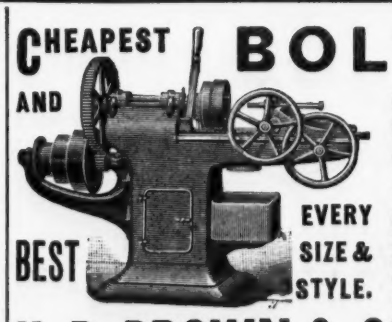

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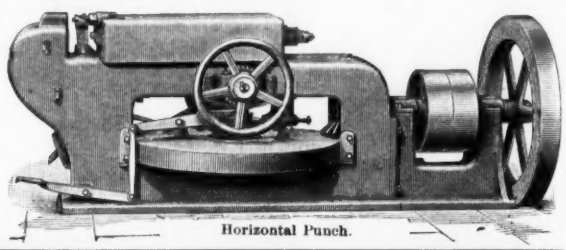

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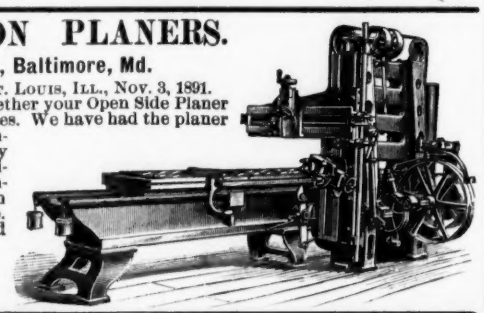

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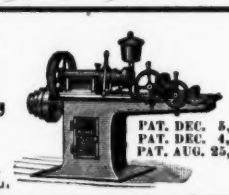

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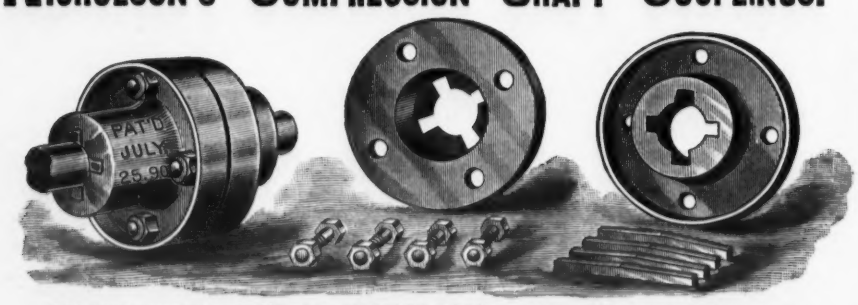

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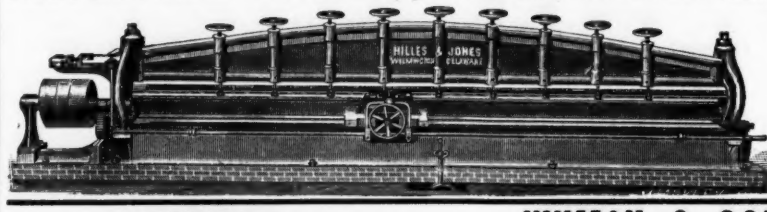

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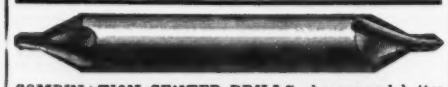

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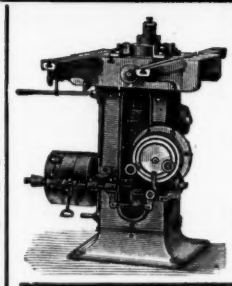

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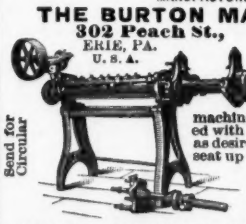

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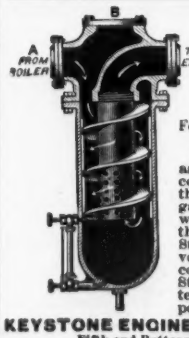

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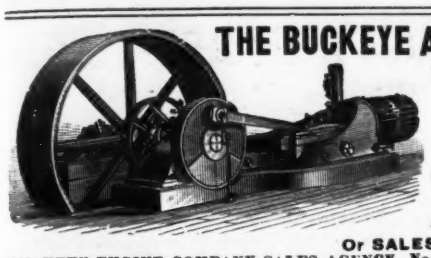

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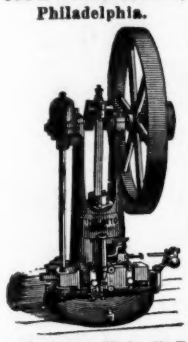

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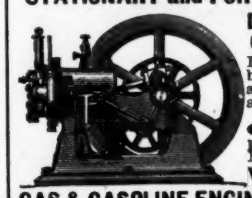

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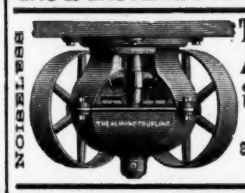

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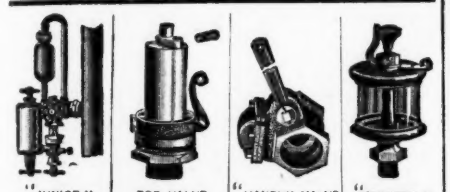

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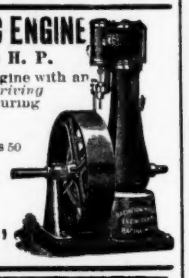

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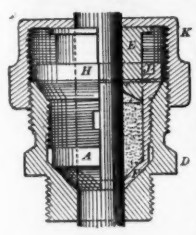

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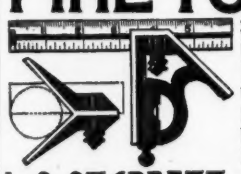

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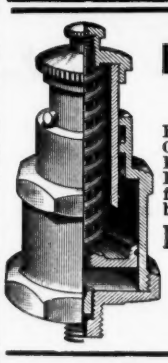

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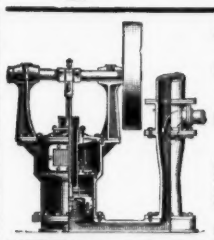

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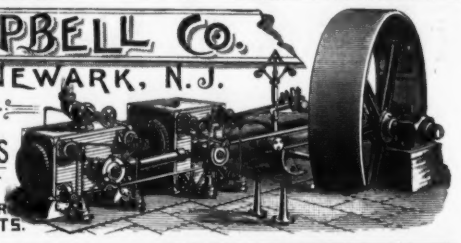

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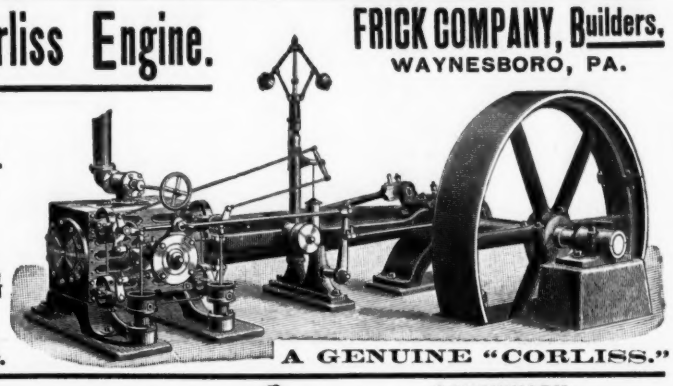

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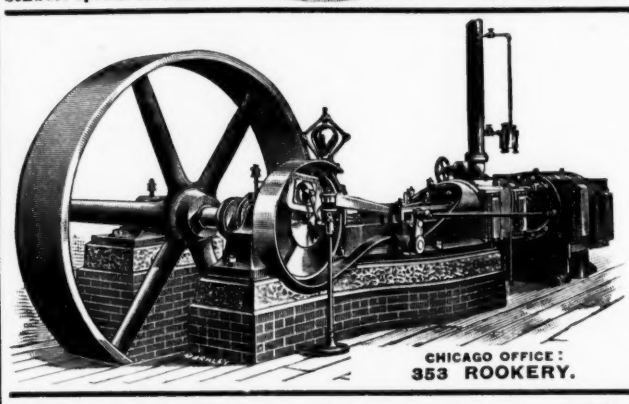

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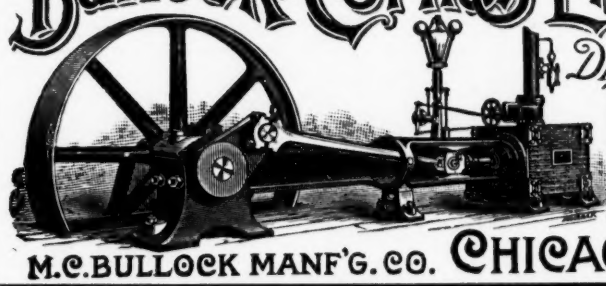

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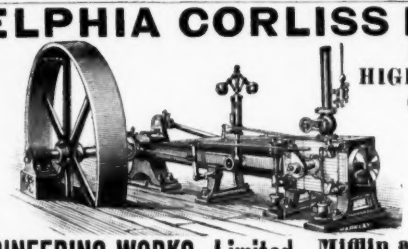

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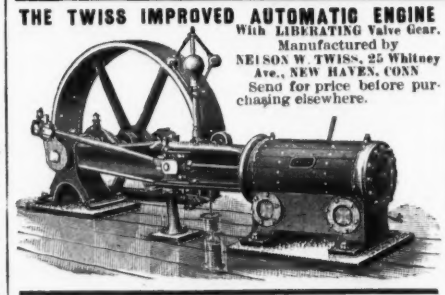

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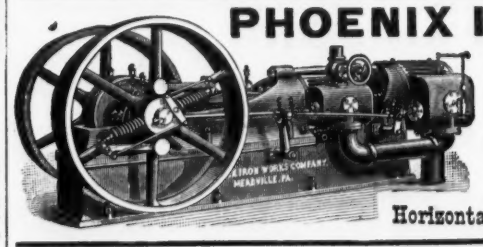

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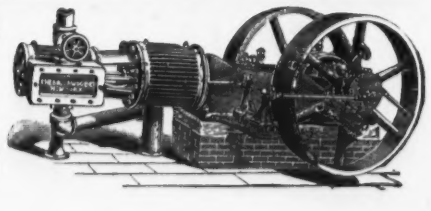

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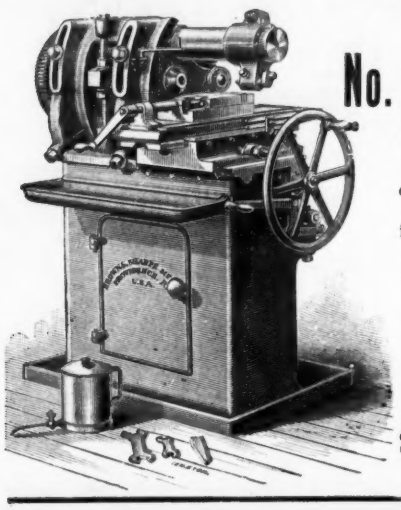

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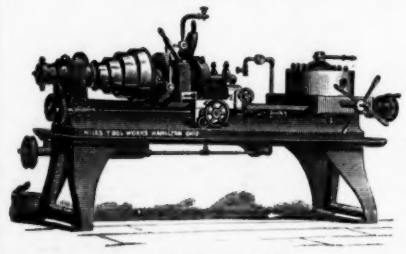

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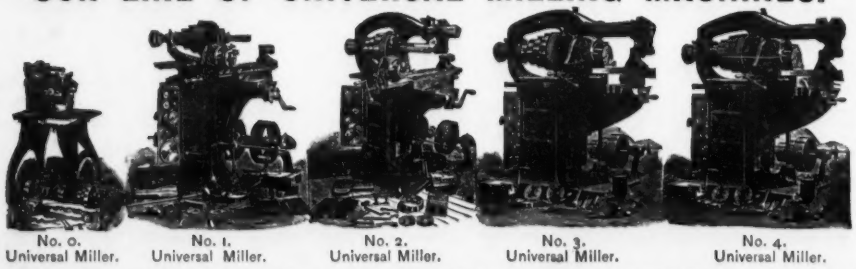

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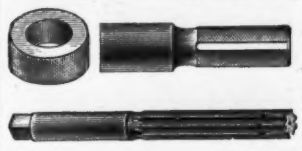

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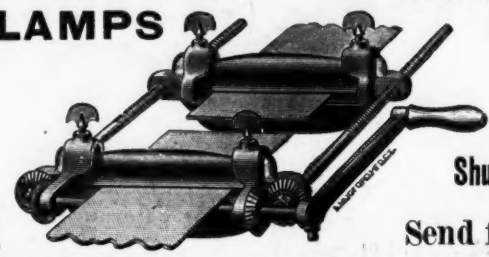

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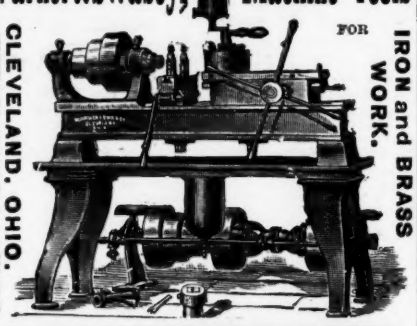

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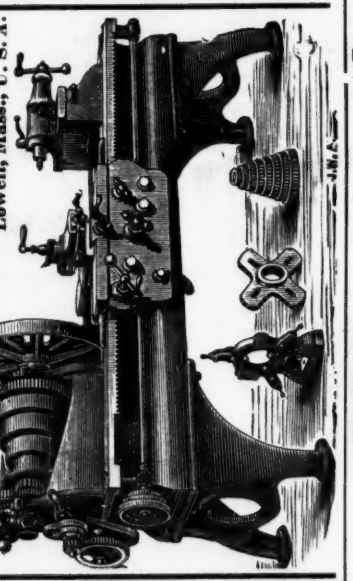

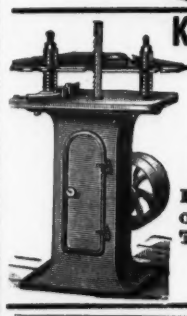

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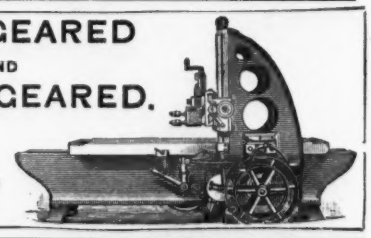

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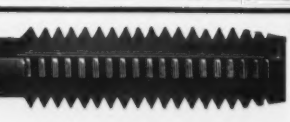

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